Test Equipment Depot
1-800-517-8431

# WVR6100 and WVR7100 Waveform Rasterizers Quick Start User Manual

Tektronix

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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

## To Avoid Fire or Personal Injury

**Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.

**Connect and Disconnect Properly.** Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground from the circuit under test before disconnecting the probe from the measurement instrument.

**Ground the Product.** This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

**Power Disconnect.** The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

**Do Not Operate Without Covers.** Do not operate this product with covers or panels removed.

**Use Proper Fuse.** Use only the fuse type and rating specified for this product.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Do Note Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**

**Provide Proper Ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

## Symbols and Terms

**Terms in this Manual.** These terms may appear in this manual:

***WARNING.*** *Warning statements identify conditions or practices that could result in injury or loss of life.*

***CAUTION.*** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

**Terms on the Product.** These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

**Symbols on the Product.** The following symbols may appear on the product:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

# Environmental Considerations

This section provides information about the environmental impact of the product.

## Product End-of-Life Handling

Observe the following guidelines when recycling an instrument or component:

**Equipment Recycling.** Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

The symbol shown to the left indicates that this product complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

**Battery Recycling.** This product may contain a Nickel Cadmium (NiCd) or lithium ion (Li-ion) rechargeable battery, which must be recycled or disposed of properly. Please properly dispose of or recycle the battery according to local government regulations.

## Restriction of Hazardous Substances

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive. This product is known to contain lead, cadmium, mercury, and hexavalent chromium.

# Preface

This manual describes installation and operation of the WVR6100 and WVR7100 Waveform Rasterizers. These instruments rasterize serial digital video and composite video signals (depending on installed options) for an XGA display, providing a new standard of display quality and flexibility. Basic operations and concepts are presented in this manual. For more detailed information, see the online help on your waveform rasterizer.

***NOTE**. This manual supports and describes the WVR7100 and WVR6100 rasterizers that were shipped with System-software version 2 and later. For earlier rasterizers that shipped with version 1 of the audio hardware, you can upgrade your instruments to the newer software version. However, the new software version only supports the old audio hardware with the original functionality with which it was shipped. You must upgrade to the new audio hardware to obtain the new audio capabilities.*

*You should use this manual with earlier rasterizers only if you have upgraded to version 2 of the System software, and then either upgraded to a new audio hardware or have no audio option installed. Otherwise, use the earlier version of the manual that shipped with your rasterizer.*

## Key Features

The WVR6100 and WVR7100 use digital processing to ensure accurate, stable, and repeatable measurements, and to provide a powerful monitoring solution for broadcasting, production, and post-production environments. The WVR7100 base instrument monitors HD SDI inputs only; the WVR6100 base instrument monitors SD SDI inputs only. Either instrument can be ordered with options that add monitoring of analog composite inputs, of multiple-channel audio, of Dolby E and/or Dolby Digital (A-3), and of the SDI physical layer with automatic measurements. The WVR7100 can also be ordered with an option to monitor SD SDI inputs. See *Options* on page 2 for information about options.

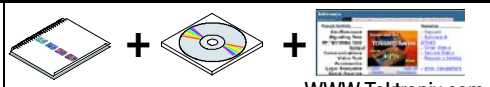
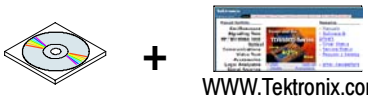
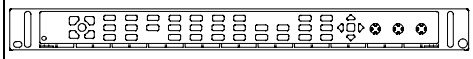
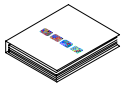
Key WVR6100 and WVR7100 features include:

- FlexVu, a four-tiled, high-resolution, XGA display that enables you to quickly check the integrity of the signal, can present four views of the signal simultaneously to monitor many aspects of the signal at the same time.
- A menu-driven user interface that requires fewer keystrokes for the most common operations and five instrument Presets for save and quick recall of commonly used configurations.
- Support for digital and analog applications (the later when equipped with optional composite-analog monitoring).
- Fully Digital Processing for accurate, repeatable, drift-free operation that surpasses traditional analog designs.
- Measurements and displays that help check performance and solve problems faster, such as:
  - Traditional waveform displays, both overlay and parade, and Vector display, both traditional and Lightning, with gain, sweep, and magnification controls.
  - Gamut monitoring, including Arrowhead, Diamond, and Split Diamond.
  - Timing and LTC Waveform Displays. LTC and VITC time code support.

- Audio support and options for viewing and monitoring AES, analog, and embedded audio and Dolby signals.
- Audio support includes viewing and monitoring of both levels of normal channel pairs or of surround channels and of phase relationships of normal channel pairs or of a user-specified pairings of channel inputs in a Lissajous display. Loudness measurement, audio control packet coding, and many popular audio scales including BBC scales are also supported.
- Surround Sound display of audio signals.
- Configurable alarms and error logging.
- Exclusive Status screens for content status at a glance.
- Support for decode and display of CC standards (EIA 608-Line 21, EIA-608-ANC, and EIA-608 (708), with caption text and V-chip information overlaid on picture (monitor mode) or in Status, Alarm, or Error screens as appropriate.
- Settings for missing (incorrectly inserted) closed captioning.
- Support for standard and custom Safe Graticules for Picture displays for monitoring for incorrect placements of graphics, logos. Two Safe Area graticules and Safe Title graticules are supported.

- More ancillary data monitoring support, include support for monitoring ancillary data conforming to ARIB standards and EIA608 Extended Data Services (XDS).
- Vector display with Composite and Component Compass Rose Graticules.
- Verification of the electrical characteristics of the SDI physical layer when equipped with one of the following two options:
  - Option Eye. Provides an Eye display, which lets you use the graticule or voltage and time cursors to measure the waveform.
  - Option PHY. Provides the features of Option EYE and adds a Jitter waveform display and automatic measurements of the SDI physical layer.
- Jitter thermometers, which provide two independent measurements of jitter and one of cable loss, and relates the measurements to defined alarm limits.
- Full remote control for complete installation flexibility.

# Documentation

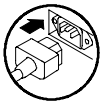
| Item | Purpose | Location |
|---|---|---|
| Quick Start User Manual (this manual) | Installation and high-level overview of instrument operation |  WWW.Tektronix.com |
| User Technical Reference | In-depth descriptions of instrument operation |  WWW.Tektronix.com |
| Online Help | In-depth instrument operation and UI help |  |
| Specifications and Performance Verification Technical Reference | Specifications and procedure for checking instrument performance | WWW.Tektronix.com |
| WVR & WFM Series Management Information Base (MIB) Reference | SNMP command reference for remotely controlling the instrument | WWW.Tektronix.com |
| Service Manual | Optional manual supporting module-level servicing of the instrument |  |

# Conventions Used in this Manual

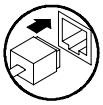
The following icons are used throughout this manual.

Sequence Step

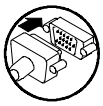
Connect power



Network



XGA



# Before Installation

## Check Package Contents

Unpack the instrument, and check that you received all items listed as *Standard Accessories*. Recommended accessories, instrument options, and upgrades are also listed in this section. Check the Tektronix Web site (www.tektronix.com) for the most current information.

## Standard Accessories

### Documents

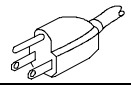
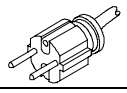
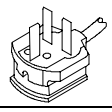
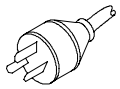
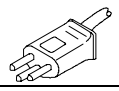
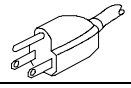
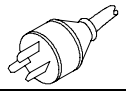
The following documents are standard accessories:

- *WVR6100 and WVR7100 Waveform Rasterizers Quick Start User Manual*, Tektronix part number 071-1588-XX
- *WVR6100 and WVR7100 Waveform Rasterizers Release Notes*, Tektronix part number 061-4295-XX
- *WVR6100 and WVR7100 Waveform Rasterizers User Documents CD*, Tektronix part number 020-2612-XX

### Power Cords

The WVR6100 and WVR7100 Waveform Rasterizers are shipped with one of the following power cord options. Power cords for use in North America are UL listed and CSA certified. Cords for use in areas other than North America are approved by at least one authority acceptable in the country to which the product is shipped.

**Power cord identification**

| Plug configuration | Normal usage | Option number |
|---|---|---|
|  | North America 120 V | A0 (Standard) |
|  | Universal Euro | A1 |
|  | United Kingdom | A2 |
|  | Australia | A3 |
|  | Switzerland | A5 |
|  | Japan | A6 |
|  | China | A10 |

# Optional Accessories

- *WVR6100 and WVR7100 Waveform Rasterizers Service Manual*, Tektronix part number 071-1589-XX.
- Analog/Audio Breakout Cable Assembly, Tektronix part number 012-1688-00.

# Options

The WVR7100 ships with support for monitoring high definition (HD) serial digital signals. You can add SD support only to the WVR7100 instrument:

- Option SD. Adds support for monitoring standard definition (SD) serial digital signals.
  - WVR7UP-SD. Adds Option SD to a previously purchased instrument.

You can add any or all of the following support options to either the WVR6100 or WVR7100 instrument::

- Option CPS. Adds support for monitoring composite analog signals.
- Option DS. Adds support for Digital audio monitoring in embedded and AES/EBU inputs.
  - WVR6UP-DS or WVR7UP-DS. Adds Option DS to a previously purchased instrument.
- Option AD. Adds support for Analog audio and Digital audio monitoring in embedded and AES/EBU inputs
  - WVR6UP-AD or WVR7UP-AD. Adds Option AD to a previously purchased instrument.
- Option DD. Adds support for Dolby Digital (AC-3) decode and Analog and Digital audio monitoring in embedded and AES/EBU inputs.
  - WVR6UP-DD or WVR7UP-DD. Adds Option DD to a previously purchased instrument.
- Option DDE. Adds support for Dolby E decode, Dolby Digital (AC-3) decode, and Analog/Digital audio monitoring in embedded and AES/EBU inputs.
  - WVR6UP-DDE or WVR7UP-DDE. Adds Option DDE to a previously purchased instrument.
- Option EYE. Adds support for monitoring the SDI physical layer using an Eye waveform display. WVR6100 instruments monitor SD signals; WVR7100 instruments monitor HD signals.
  - WVR6UP-EYE or WVR7UP-EYE. Adds Option EYE to a previously purchased instrument.
- Option PHY. Adds the capabilities of Option EYE and adds a Jitter waveform display and automatic measurements of the SDI physical layer. WVR6100 monitor SD signals; WVR7100 instruments monitor HD signals.
  - WVR6UP-PHY or WVR7UP-PHY. Adds Option PHY to a previously purchased instrument.

You can add any or all of the following service options to the WVR6100 or WVR7100 instruments:

- Option C3. Adds 3 years of Calibration Service.
- Option C5. Adds 5 years of Calibration Service.
- Option D1. Adds a Calibration Data Report.
- Option D3. Adds 3 years of Calibration Data Report (when ordered with option C3)
- Option D5. Adds 5 years of Calibration Data Report (when ordered with option C5)
- Option R3. Adds 3 years of Repair Service (including the period under warranty)
- Option R5. Adds 5 years of Repair Service (including period under warranty)

# Installation

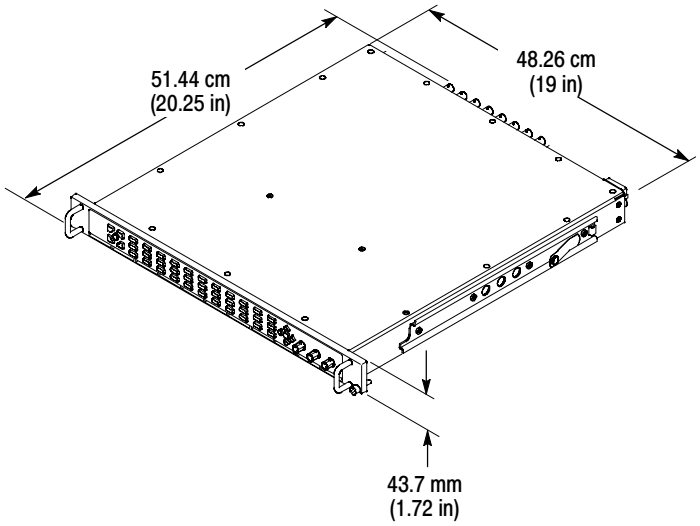
This section provides instructions for installing the waveform rasterizer into a standard instrumentation rack for both the standard configuration and when configured with the remote front panel option. At installation time, save the shipping carton and packing materials (including the anti-static bag) in case you need to ship the instrument.

## Rackmount Installation

The waveform rasterizer ships with hardware for rackmounting and fits in a standard 19-inch rack. Requirements of the rack follow:

- Spacing between the front rails must be at least 17-¾ inches.
- Front-to-rear rail spacing must be between 15-½ and 28 inches.
- Six inches of clearance between the instrument rear panel and any rear cabinet panel for connector space and to provide adequate air circulation.

Instrument dimensions are shown at right.

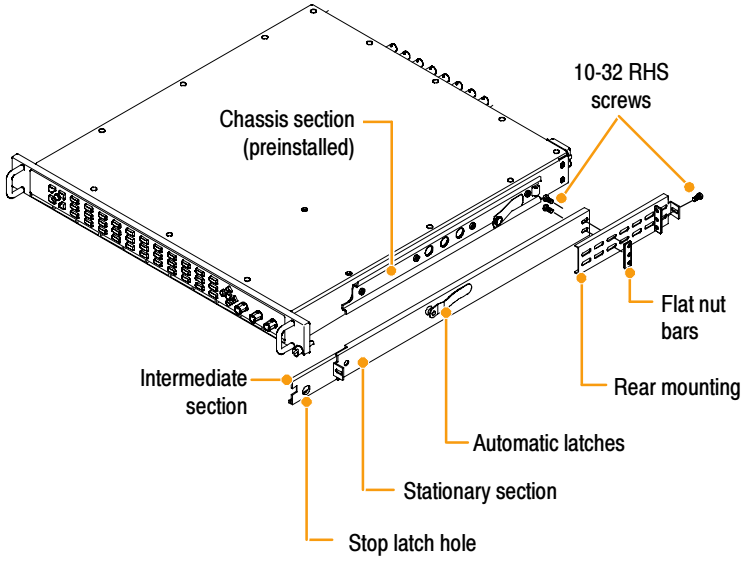



### Mounting the Slide Tracks

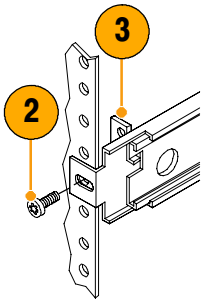
The procedure covers rear rail mounting details for both deep and shallow racks.

1. Mount the rails using the enclosed hardware as shown at right.

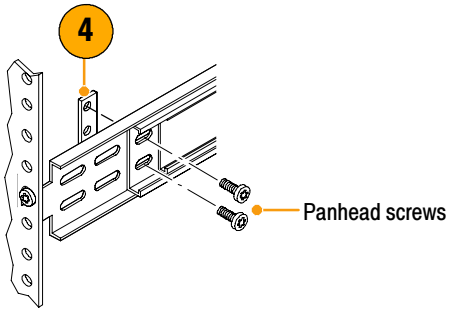
   ***NOTE**: Right hand and left hand stationary section is designated by the RH and the LH marked on the rails. Stop latch holes should be towards the bottom when slides are in place. (The right hand rail is shown.)*



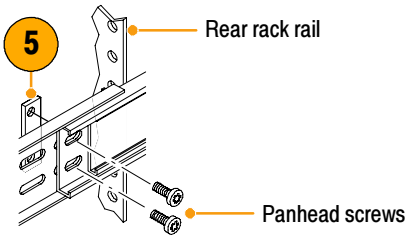
2. Screw-mount to the front rail as shown.
3. Install Bar nut if the front rail mounting hole is not tapped.




4. For a deep configuration, rear mount as shown. Make sure that the stationary sections are horizontally aligned, level, and parallel.



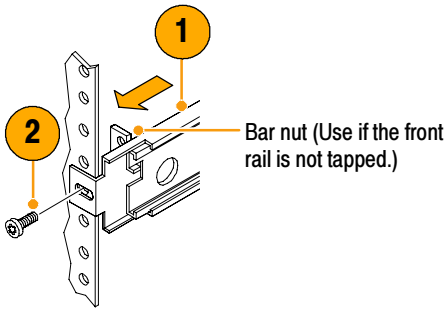

5. Alternately, for a shallow configuration, rear mount as shown. Make sure that the stationary sections are horizontally aligned, level, and parallel.




## Rack Adjustments

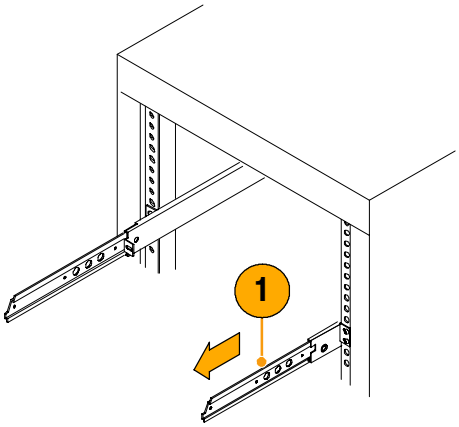
If, after installation, the slide tracks bind, adjust the tracks as follows.

1. Slide the instrument out about 10 inches, slightly loosen the screws holding the tracks to the front rails, and allow the tracks to seek an unbound position.
2. Retighten the screws and check the tracks for smooth operation by sliding the instrument in and out of the rack several times.

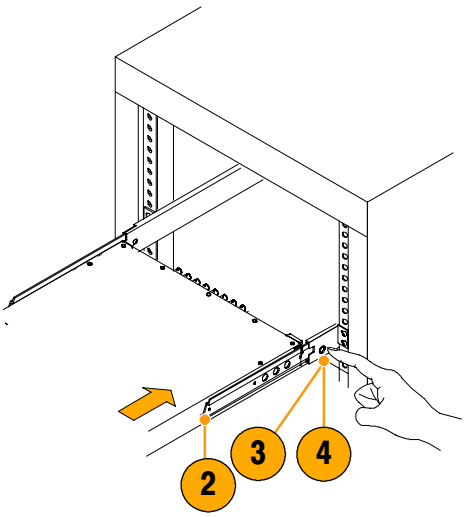


## To Install the Instrument

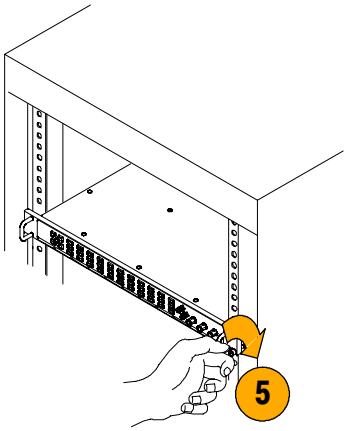
1. Pull the slide-out track section to the fully extended position.




2. Insert the instrument chassis sections into the slide-out sections.
3. Press the stop latches, and push the instrument toward the rack until the latches snap into their holes.
4. Press the stop latches again, and push the instrument fully into the rack.

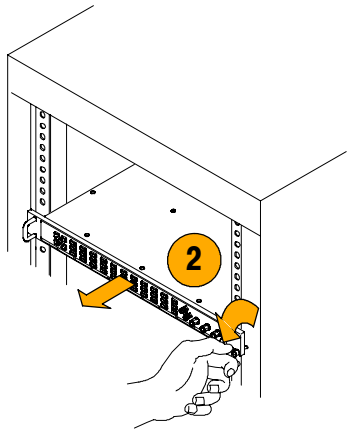



5. Tighten the front-panel retaining screws.

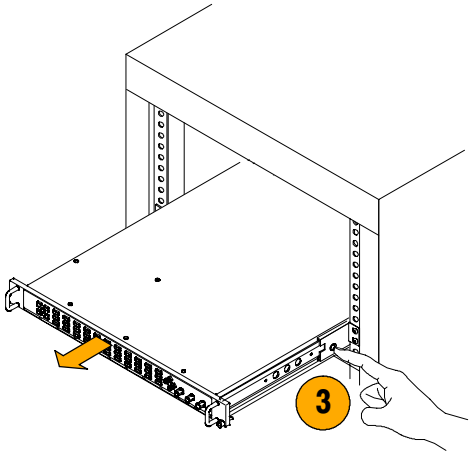


### To Remove the Instrument

1. Before removing the instrument, be sure to disconnect all cabling.
2. Loosen retaining screw and pull instrument outward until the stop latches snap into the holes.




3. Press stop latches (visible in the stop-latch holes) and carefully slide the instrument free from the tracks.




### Rack Slide Maintenance

The slide-out tracks do not require lubrication. The dark gray finish on the tracks is a permanent, lubricated coating.

## To Connect a Display

First, loosen the front-panel knurled retaining screw. See step 2 on page 7. Grasp the front handles, and pull the instrument out until all three slide sections latch. The instrument is firmly held in this position.

You are now ready to connect power and signal cables to the instrument.

The WVR6100 and WVR7100 supports standard analog PC monitors, either CRT or LCD. The display resolution is 1024 X 768 (XGA). Connect the external display to the rear-panel XGA OUTPUT connector. The XGA OUTPUT connector is a standard 15-pin D-type connector with socket contacts. To select the display type, display the CONFIG menu, select Display Setting, and then Picture Refresh Mode. Select CRT or Interlaced for Monitors and LCD for LCD displays. Push the HELP button after selecting Picture Refresh Mode for information about these settings.

# To Connect Power and Powering On/Off

The waveform rasterizer operates from a single-phase power source with the neutral conductor at or near earth ground. The line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the power cord is essential for safe operation.

## AC Power Requirements

The waveform rasterizer operates from an AC line frequency of 50 or 60 Hz, over the range of 100-240 Volts, without the need for configuration, except the power cord. Refer to page 1 for the power cord options. The typical power draw is 50 W. Refer to the *Specifications and Performance Verification* on the *User Documents CD* for additional information on power and environmental requirements.

Connect the supplied power cord to the rear-panel power connector. There is no power switch on the waveform rasterizer, so the instrument will turn on as soon as you apply power.

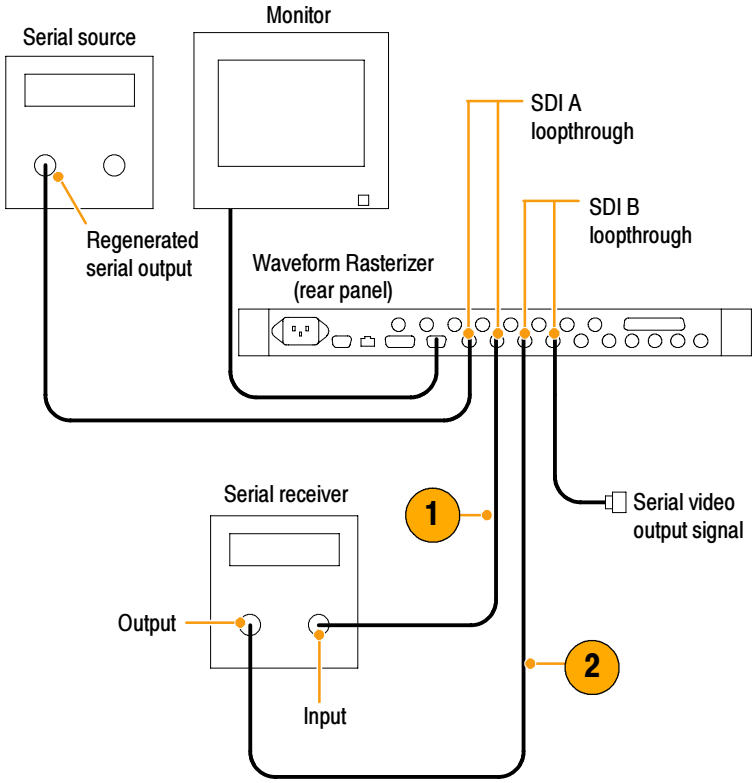
# To Install in a Video System

The waveform rasterizer can operate almost anywhere in the distribution system due to its high impedance, bridging, and loop-through inputs. This section describes two types of connections and presents information on line termination. The following diagrams are for serial digital systems, but similar connections are common for the analog composite inputs on the waveform rasterizer.

## To install for monitoring the video bit stream of a serial receiver

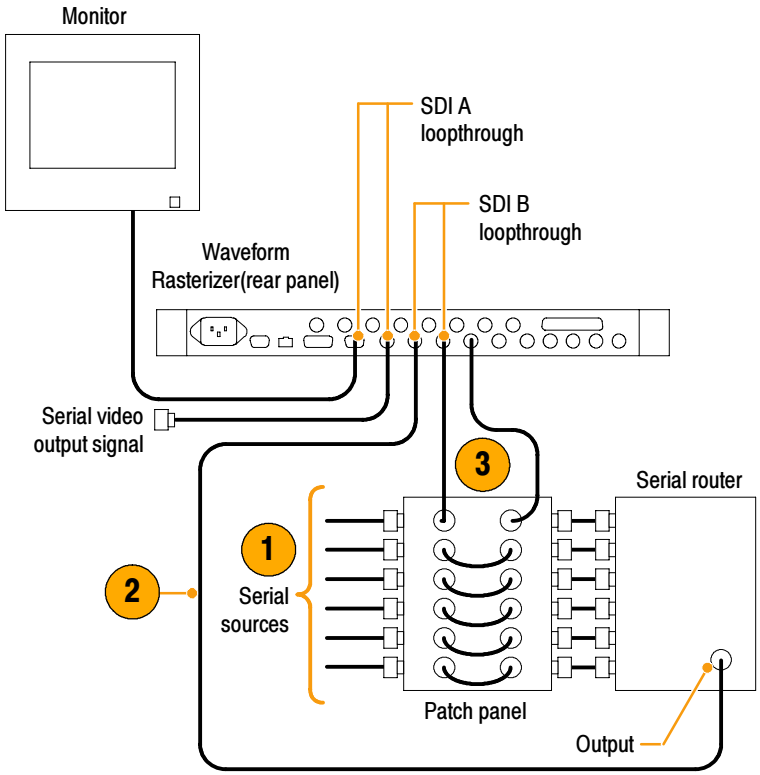
1. Route the incoming serial signal through one of the waveform rasterizer loop-though inputs.
2. Connect the output of the serial receiver to the other loop-through input, so you can compare the incoming signal and the regenerated output signal.

   ***NOTE.*** *See the Specifications on the* WVR6100 and WVR7100 User Documents CD *for maximum cable lengths allowed.*



## To install monitoring serial digital signals around a routing switcher

1. Connect your serial sources through a patch panel to a serial router.
2. Connect the output of the serial router to a SDI loop through input for comparison.
3. Connect the other SDI loop-through input to the patch panel to jumper the signal that you want to compare to signal connected in step 2.




## Line Termination

The waveform rasterizer uses passive loop-through, serial and analog video inputs. Accordingly, the loop-through input must be terminated externally. The passive loop-through capability of the inputs provides the benefit of a signal path that is uninterrupted by input selection, power interruption, and even most internal faults. In addition, the waveform rasterizer directly monitors the actual signal traveling to downstream equipment rather than providing a re-transmitted signal or requiring a duplicate input signal.

The loop-through capability is especially useful with the EYE and PHY options because it allows inspection of the actual signal on the cable. However, the signal received by the waveform rasterizer is also dependent on the quality of the downstream cabling and termination. Terminations with poor high frequency characteristics, 50 Ω BNC barrels, patch panel bulkhead feed-throughs, and other poor cabling practices cause reflections, which can result in excessive eye closure, jitter above 100 kHz, data errors, and even loss of lock at the waveform rasterizer.

**Termination Requirements.** If the waveform rasterizer is installed to monitor an operating link, the destination receiver and the connecting cable serve as the termination. This monitoring connection is best because it checks the performance of the entire serial path. The return loss of the waveform rasterizer is sufficiently high that, in most cases, the destination receiver sets the system return loss.

In cases where the waveform rasterizer is placed at the end of a link, a BNC terminator must be installed on one side of the loop-through input. The termination must be 75 Ω and DC coupled (good return loss extends to DC). Return loss must exceed the following requirements:

- Standard definition (SD) signals: >25 dB from 10 kHz to 270 MHz.
- High definition (HD) signals: >25 dB from 10 kHz to 1.5 GHz.
- Composite signals: >40 dB from DC to 6 MHz.

Most terminators designed for analog video have poor characteristics in the 20 MHz to 2 GHz range needed for SDI interconnection. One example of a terminator with good high-frequency characteristics is the Canare BCP-TA.

### Compatibility of BNC Center Pins

Most video equipment BNC connectors, whether 50 or 75 Ω, use a 50 Ω standard center pin. Some laboratory 75 Ω BNC connectors use a smaller diameter center pin. The BNC connectors on the waveform rasterizer are designed to work with the 50 Ω standard (large diameter) center pins.

Do not use connectors or terminators with the smaller center pins. They could cause intermittent connections.

### Connecting to Monitors and Projectors Issues

Some monitors or projectors may have trouble adapting to the XGA output from the waveform rasterizer. This is because there may not be any significant signal in all four corners of the raster, so the monitor cannot find the edges of the active area. To overcome this, select Status in all four tiles of the waveform rasterizer display, and then cycle the power on the monitor to force it to reconfigure. If necessary, adjust the horizontal and vertical position and size to optimize the image, and set the Picture Refresh Rate to match the monitor. (See *To Connect a Display* on page 7.)

## Incoming Inspection

At your option, you can complete incoming inspection procedures. These procedures require no equipment aside from a display, to check functionality. You will find the incoming inspection procedures in the *WVR6100 and WVR7100 User Technical Reference* that is included on the *User Documents CD* that shipped with your waveform rasterizer.

# How to Operate Your Instrument

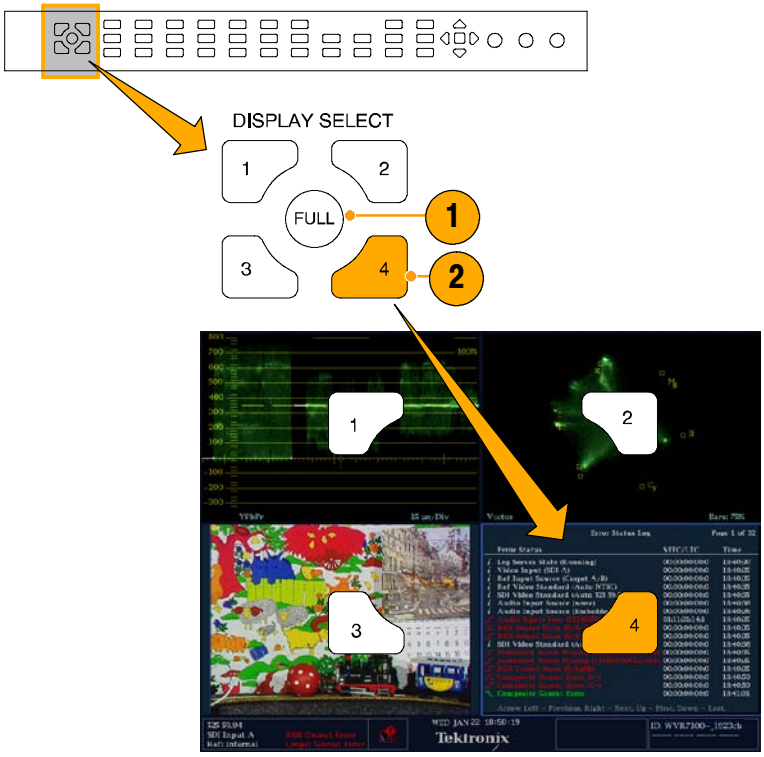
## Getting Acquainted

The waveform rasterizer uses a flexible, tiled display. The waveform rasterizer can display four tiles at one time. Each tile can display a different measurement, effectively creating four independent instruments. To enable the tiles to function independently, most of the controls only affect one tile at a time.

### To Control the Display:

1. To switch to tiled mode, toggle the FULL button until it is unlit and there are four displays shown.
2. To select a tile to control, push one of the numbered tile buttons.

   Note that the button you select lights and that a light-blue outline surrounds the tile. Both the lit button and the light-blue outline indicate the active, selected tile. Tile 4 is shown selected here.

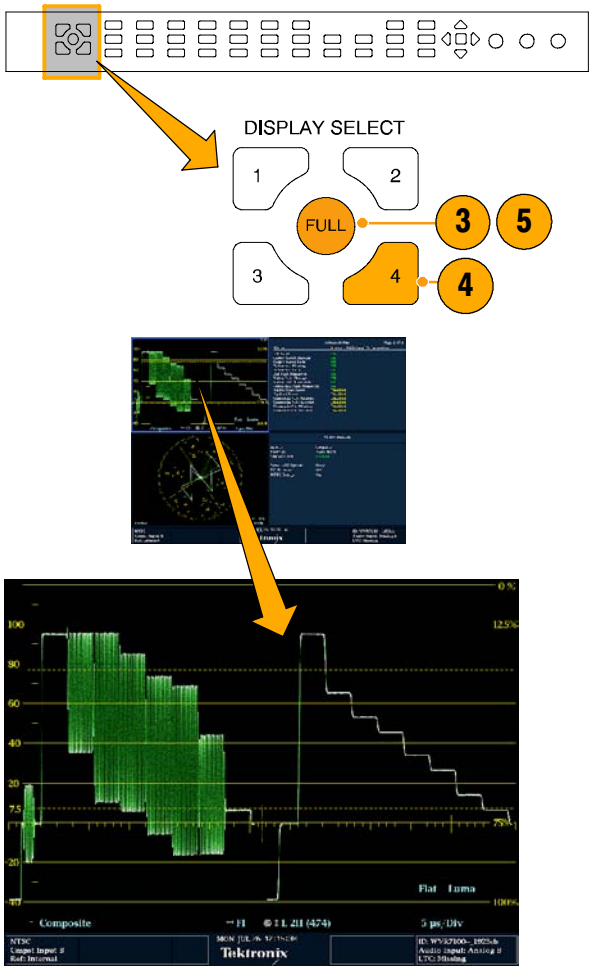


3. To display the selected tile full screen, toggle the FULL button until it is lit and the selected tile fills the screen.

   In a full display, the displayed tile is always selected.

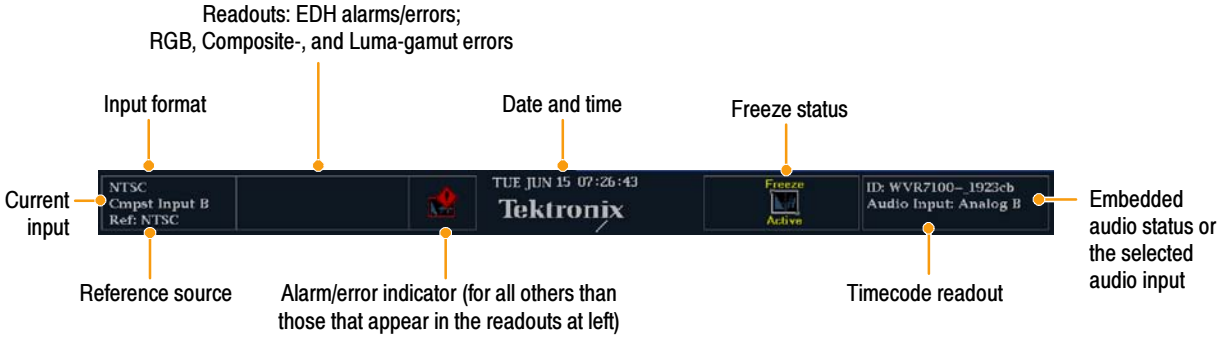
4. To select another tile, just push its button. The tile you select will replace the previously selected tile, displaying full screen.

5. Push the FULL button again to toggle to the four-tile display.



## To Determine Status At-a-Glance

The Status Bar, located at at the bottom of the waveform rasterizer display, shows information on the status of instrument and of the monitored signal. The various elements detailed below describe the conditions that you can see at a glance in the Status Bar.




| Display element | Description |
|---|---|
| Input Format | Text indicating the format of the signal on the selected input or whether signal is missing or unlocked. |
| EDH Error | A one-line area that is visible if EDH errors are present. |
| RGB Gamut Error[1] | A one-line area that is visible if RGB gamut errors are present. |
| Composite Gamut Error[1] | A one-line area that is visible if Composite gamut (Arrowhead) errors are present. |
| Luma Gamut Errors | A one-line area that is visible if Luma errors are present. |
| Alarm/Error Indicator | An icon visible when alarms of types other than those in the four readouts just listed occur. |
| Date and Time | Readout of the date and time (set in CONFIG > Utilities). |
| Instrument Name | Name assigned to the waveform rasterizer in the CONFIG > Utilities menu. |
| Audio Status | A 16-character string indicating the selected audio input or the embedded audio channel status, when embedded audio is the selected input, In the latter case, each character shows the status of a specific channel: **-** for not present and **P** for present. |
| Timecode Readout | A readout showing the selected time-code value |
| Reference Source | Text indicating the source of the current reference. Possible references are: Ext., Internal. Also indicates format and whether the reference is missing or unlocked. |
| Current Input | Text indicating the selected input. Possible inputs are: SDI A, SDI B, Cmpst A, Cmpst B (depending on installed options). Also indicates if the current input is not in Auto mode and is unlocked. |

1 Because RGB and Composite Gamut messages appear on the same line in the display, if both RGB and Composite Gamut errors are present at the same time, the message “RGB and Cmpst Gamut” will appear.

### Status Bar Icons

| Display Icons | Description |
|---|---|
| | Warning – Appears when an error or an alarm that is mapped to the user interface triggers. |
| | Alarms Muted – Appears when the alarms are muted from the STATUS pop-up menu. |
| | Remote Access – Appears when the waveform rasterizer is accessed from the network. For example, when the sending commands to the waveform rasterizer from the remote interface. |
| | Alarms Disabled – This text appears in the Status Bar when Alarms are disabled from the Configuration menu. |
| | Freeze Active – Appears when the tiles are frozen. |

# Front-Panel Controls

***NOTE.*** *Some of the controls that this section covers may not be present on your rasterizer, depending on which options are installed. For a list of the options that are installed on your product, press the* CONFIG *button. In the* CONFIG *menu, select the* Utilities *submenu. The* View Instruments Options *entry lists the installed options for your instrument.*

### Three Levels of Control

You control the waveform rasterizer on three levels:

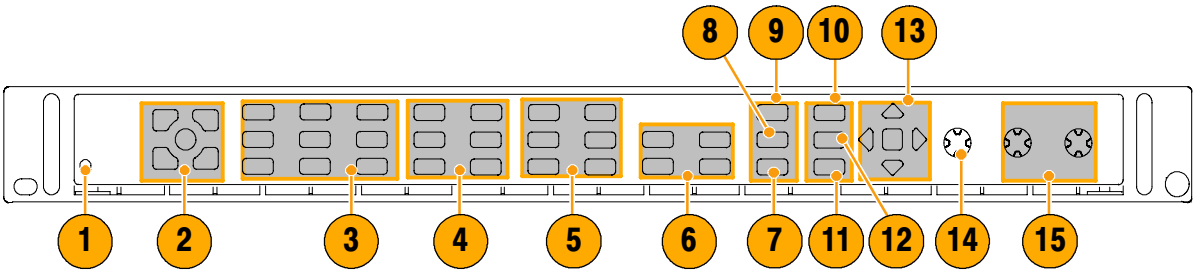
- **Frequently changed settings.** The front-panel buttons control the most commonly changed parameters, such as which measurement appears in each tile. The knobs are used to adjust levels and make selections.
- **Tile-specific settings.** Pop-up menus control parameters that are specific to the tile in which they are displayed. The pop-up menus control less frequently changed parameters such as the waveform display mode (for example, changing the waveform display mode from RGB to YPbPr). To display a pop-up menu, press and hold the desired MEASURE SELECT or DISPLAY SELECT button for about a second.
- **Instrument-wide settings.** The parameters in the Configuration menu are instrument-wide settings. The configuration menu controls settings that are changed only occasionally, such as changing waveform color or setting the network address.

## Scope of Controls

Some controls are global and affect all tiles, while other controls only affect the active tile. Generally speaking, if a control is configured by front-panel buttons or by a pop-up menu, it is tile specific. (Exceptions are the Input buttons, and all audio features, both of which are global.) If control is configured by the CONFIG menu, selections are usually global.

## Layout and Usage

The front panel elements are shown below, referenced to the usage procedures that explain their operation.



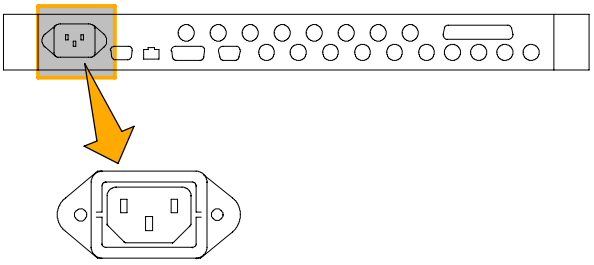

| Index | Control Element or Group | Usage Procedures |
|---|---|---|
| 1 | FAULT (alarm) light | None. Indicates a hardware problem requiring servicing |
| 2 | Tile-selector and tile buttons | *To Control the Display* on page 11 |
| 3 | Measurement buttons | *To Select a Measurement* on page 22<br>*To Set Measurement Parameters* on page 23 |
| 4 | Gain and Sweep Buttons | *To Set Gain and/or Sweep* on page 25 |
| 5 | Preset Buttons | *To Use Presets* on page 27 |
| 6 | Input Selection Buttons[1] | *To Select Among Inputs* on page 24 |
| 7 | Line Select button | *To Set Line Select Mode* on page 32 |
| 8 | Ext REF | *How To Time a Studio* on page 36 |
| 9 | Freeze button | *To Freeze the Display* on page 30 |
| 10 | Help button | *To Use Online Help* on page 34 |
| 11 | Cursors button | *To Measure Waveforms with Cursors* on page 28 |
| 12 | Configuration menu button | *To Configure Your Instrument* on page 33 |
| 13 | Up/Down/Left/Right Arrow keys and Sel Button | Demonstrated in *To Set Measurement Parameters* on page 23 |
| 14 | General Knob | Demonstrated in *To Select/Adjust a Parameter* on page 33 |
| 15 | Vertical and Horizontal Knobs | None. Use to position waveforms when displayed in tiles or full screen. |

[1] Composite buttons present for Option CPS-equipped instruments only.

# Rear-Panel Controls

## Power Requirements

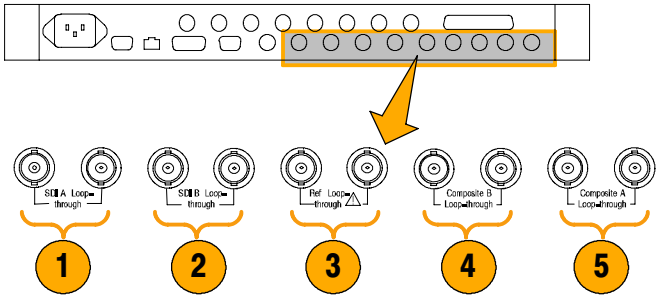
- A single-phase power source with one current-carrying conductor at or near earth-ground (the neutral conductor).
- A power source frequency is 50 or 60 Hz, and a operating voltage range is from 100 to 240 VAC, continuous.
- Systems with both current-carrying conductors live with respect to ground (such as phase-to-phase in multiphase systems) are not recommended as power sources.



***NOTE.*** *Only the line conductor is fused for over-current protection. The fuse is internal.*

## Video Input Connectors

All are passive, loop-through inputs, compensated for 75 Ω




1. **SDI A Loop-through**. The A component serial digital input[1]
2. **SDI B Loop-through.** The B component serial digital input[1]
3. **Ref Loop-through.** A synchronization input. The input signal can be analog black burst or analog composite video.
4. **Composite A Loop-through.** The A composite analog input[2]
5. **Composite B Loop-through.** The B composite analog input[2]

1 WVR7100 instruments: Accept HD inputs only unless Option SD-equipped. Option SD-equipped instruments accept and automatically detect both HD and SD signals.

WVR6100 instruments: Accept SD inputs only and cannot accept HD signals.

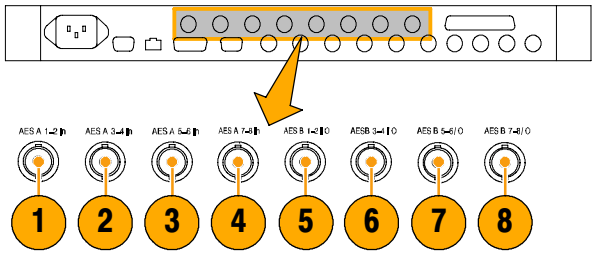
2 Input not present unless instrument is Option CPS-equipped.

## AES A/B Connectors

These BNC connectors support AES audio inputs based on the audio options installed. (Options are listed on page 2.)

## Connector Label

1. AES A 1-2 In
2. AES A 3-4 In
3. AES A 5-6 In
4. AES A 7-8 In
5. AES B 1-2 I/O[1]
6. AES B 3-4 I/O[1]
7. AES B 5-6 I/O[1]
8. AES B 7-8 I/O[1]




## Connector Label Key:

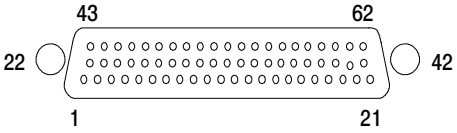
| | | |
|---|---|---|
| AES A<br>AES B | 1-2<br>3-4<br>5-6<br>7-8 | In<br>I/0 |
| A or B | Channels supported | Input or Input/Output |

[1] The AES B connectors can output AES audio (from Analog, Digital, or Dolby) when configured from the Configuration menu.

## Analog Input/Output Connector

The Analog I/O connector is used to input and output analog signals. The Analog I/O connector is a 62-pin, D-subminiature connector. Pin out and pin names follow.

***CAUTION.*** *Use care when connecting the Analog Audio Output. Refer to the instrument Specifications, to ensure Audio Load and Output Power meet specifications. Exceeding Analog Audio Output Power may result in damage to the instrument.*




**Key:**

| | | | |
|---|---|---|---|
| ANALOG_INPUT | _A | 1 | _N |
| ANALOG_OUTPUT | _B | 2 | _P |
| | | 3 | |
| | | 8 | |
| Balanced differential analog audio input or output | Input A<br>Input B | Chan 1<br>Chan 2<br>Chan 3<br>Chan 8 | N=Negative<br>P= Positive |

| Pin | Pin name | Pin | Pin name |
|---|---|---|---|
| 1 | ANALOG_INPUT_A1_P | 2 | ANALOG_INPUT_B1_P |
| 3 | ANALOG_INPUT_A2_P | 4 | ANALOG_INPUT_B2_P |
| 5 | ANALOG_INPUT_A3_P | 6 | ANALOG_INPUT_B3_P |
| 7 | ANALOG_INPUT_A4_P | 8 | ANALOG_INPUT_B4_P |
| 9 | ANALOG_INPUT_A5_P | 10 | ANALOG_INPUT_B5_P |
| 11 | ANALOG_INPUT_A6_P | 12 | ANALOG_INPUT_B6_P |
| 13 | GND (Ground) | | |
| 14 | ANALOG_OUTPUT_1_P | 15 | ANALOG_OUTPUT_2_P |
| 16 | ANALOG_OUTPUT_3_P | 17 | ANALOG_OUTPUT_4_P |
| 18 | ANALOG_OUTPUT_5_P | 19 | ANALOG_OUTPUT_6_P |
| 20 | ANALOG_OUTPUT_7_P | 21 | ANALOG_OUTPUT_8_P |
| 22 | ANALOG_INPUT_A1_N | 23 | ANALOG_INPUT_B1_N |
| 24 | ANALOG_INPUT_A2_N | 25 | ANALOG_INPUT_B2_N |
| 26 | ANALOG_INPUT_A3_N | 27 | ANALOG_INPUT_B3_N |
| 28 | ANALOG_INPUT_A4_N | 29 | ANALOG_INPUT_B4_N |
| 30 | ANALOG_INPUT_A5_N | 31 | ANALOG_INPUT_B5_N |
| 32 | ANALOG_INPUT_A6_N | 33 | ANALOG_INPUT_B6_N |
| 34 | GND | 35 | ANALOG_OUTPUT_1_N |

| Pin | Pin name | Pin | Pin name |
|---|---|---|---|
| **36** | ANALOG_OUTPUT_2_N | **37** | ANALOG_OUTPUT_3_N |
| **38** | ANALOG_OUTPUT_4_N | **39** | ANALOG_OUTPUT_5_N |
| **40** | ANALOG_OUTPUT_6_N | **41** | ANALOG_OUTPUT_7_N |
| **42** | ANALOG_OUTPUT_8_N | **43** | NC |
| **44** | NC | **45** | NC |
| **46** | NC | **47** | NC |
| **48** | NC | **49** | NC |
| **50** | NC | **51** | NC |
| **52** | NC | **53** | NC |
| **54** | NC | **55** | NC |
| **56** | NC | **57** | NC |
| **58** | NC | **59** | NC |
| **60** | NC | **61** | NC |
| **62** | NC | | |

**Connecting Signals.** When connecting audio signals to the Analog Input connectors, you can use either balanced or unbalanced signals. If you connect unbalanced signals to the inputs, you should connect the unbalanced output hot lead to the balanced input positive pin and the unbalanced cold lead to the balanced input negative pin.

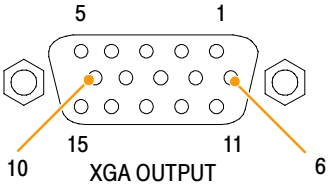
When connecting the Analog Output connectors, you can connect them as balanced or unbalanced. However, if you connect the balanced outputs to an unbalanced input, you must ground the unused lead. You can ground either lead, but using the negative output and grounding the positive output will effectively invert the phase.

***NOTE**. Note that grounding the unused lead does not attenuate the output but it does halve the clipping level. Therefore, you must attenuate the output by at least 6 dB to avoid clipping. The output signal level in unbalanced mode is double the signal level in balanced mode.*

Units that have both analog and digital capability can have AES or embedded inputs converted to analog and then routed to the eight balanced outputs.

## XGA Connector and Pin Out

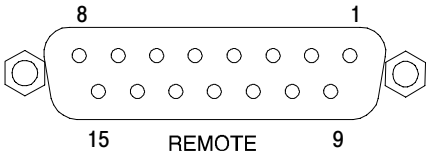
This is the display output. The display resolution is 1024 x 768, in 16 colors. The output is compatible with standard analog PC monitors, either CRT or LCD-based. The REMOTE connector is a 15-pin D-type connector with socket contacts.




| Pin | Pin name |
|---|---|
| 1 | Red Video |
| 2 | Green Video |
| 3 | Blue Video |
| 4 | Not connected |
| 5 | Ground |
| 6 | Red Ground |
| 7 | Green Ground |
| 8 | Blue Ground |
| 9 | +5 V (For monitor EEPROM) |
| 10 | Not Connected |
| 11 | Not Connected |
| 12 | ID Bit ($I^2C$ polling is not supported) |
| 13 | Horizontal Sync |
| 14 | Vertical Sync |
| 15 | ID Clock |

## Remote Connector and Pin Out

The REMOTE connector interface uses ground closures for remote control and indicating to external equipment when alarms have occurred. The input of LTC is through the REMOTE connector. The REMOTE connector is a 15-pin D-type connector with socket contacts.



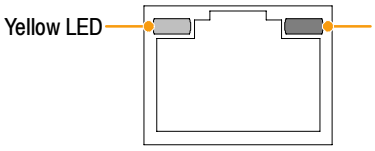

| Pin | Pin name |
|---|---|
| 1 | Reserved for future use |
| 2 | GND |
| 3 | Reserved for future use |
| 4 | Reserved for future use |
| 5 | Recall Preset 1 |
| 6 | GND |
| 7 | +Time Code (IN) (Longitudinal Time Code inputs) |
| 8 | -Time Code (IN) (Longitudinal Time Code inputs) |
| 9 | Output (Goes to GND if alarm asserted and if enabled) |

| | |
|---|---|
| **10** | Reserved for future use |
| **11** | Reserved for future use |
| **12** | Reserved for future use |
| **13** | Recall Preset 2 (IN)[1] |
| **14** | Recall Preset 3 (IN)[1] |
| **15** | Recall Preset 4 (IN)[1] |

[1] Asserting one of the Preset signals causes the associated front-panel preset to be applied to the rasterizer Assert a pin by connecting it to ground.

## Ethernet Connector

The waveform rasterizer provides a 10/100 BaseT Ethernet interface. The Ethernet connector is a standard RJ-45 connector.



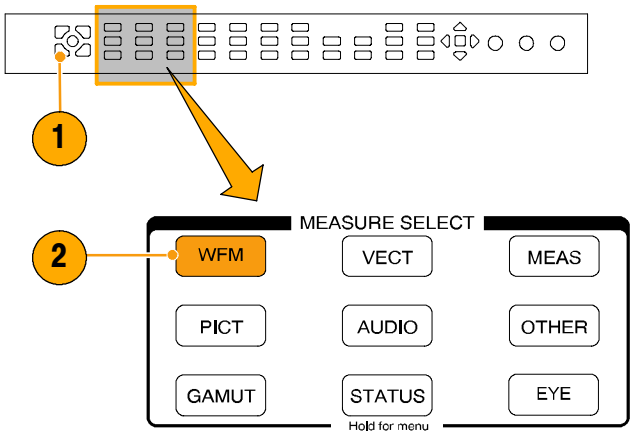

- Lit Green LED indicates connection is active
- Lit Yellow LED indicates a 100 MB transmission rate
- Unlit Yellow LED indicates a 10 MB transmission rate

# To Select a Measurement

After you have selected a tile, you can choose what to display in it. Measurement/Display type is independent for each tile.

1. Select a tile as instructed in *To Control the Display* on page 11.
2. Push a button corresponding to the measurement that you want to display in the selected tile:
   - WFM - display of video waveform
   - PICT - display of the picture generated by the video signal
   - GAMUT - display selectable for three proprietary Tektronix views for checking the gamut of an SDI signal
   - VECT - display of Vector or Lightning plots of color signals
   - AUDIO - optional display of level (meters) and of a phase (plot) for monitoring audio signals If option DD or DDE is present, you also display Surround Sound
   - STATUS - extensive displays views of signal status
   - MEAS - a Tektronix proprietary display that simplifies timing correction
   - OTHER - display for checking the LTC amplitude and noise, and verify LTC is locked to the video
   - EYE- display for checking the transport layer of an SDI signal, including jitter

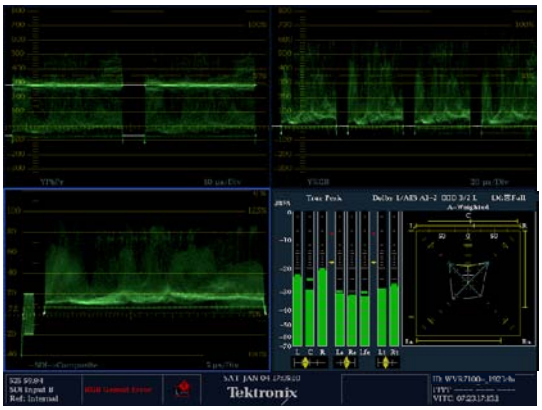
   ***NOTE.*** *The EYE button is missing on older instruments. On those instruments, use the MEAS button to access the Eye and Jitter displays.*



3. Repeat steps 1 and 2 until you have selected measurement displays for all tiles that you wish to define.
4. To display the same measurements in more than one tile, select each tile in sequence, and then choose the same measurement for each one.

   The display at right shows the display with WFM selected for three tiles.

   ***NOTE.*** *Audio is the only measurement that can be displayed in only one tile at a time.*

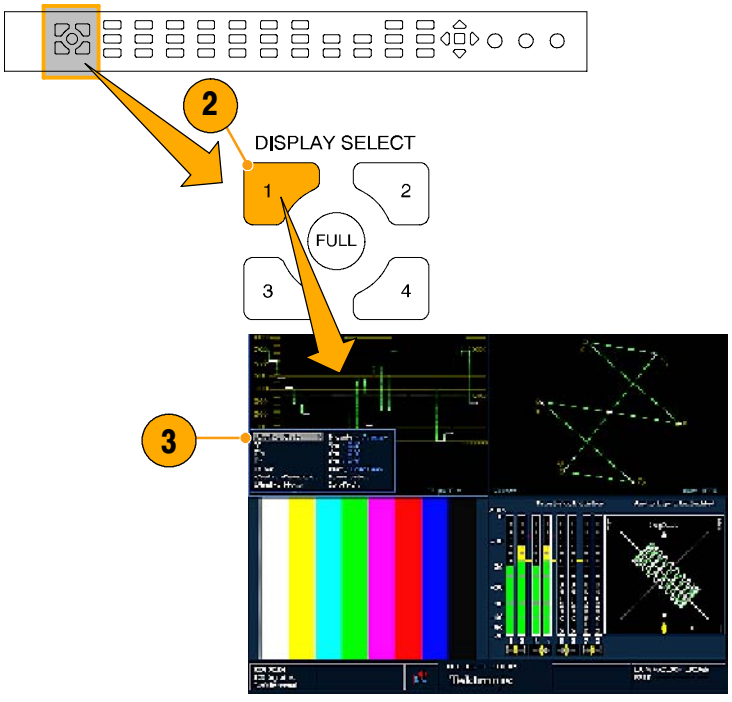


## To Set Measurement Parameters

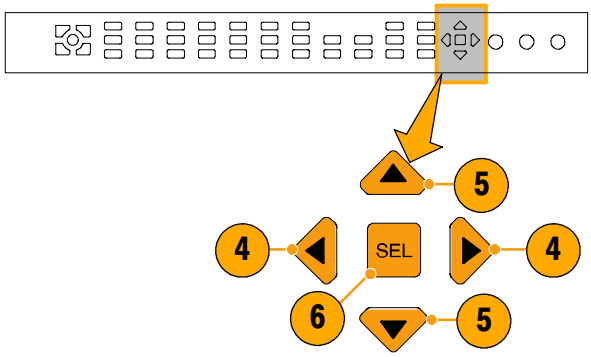
You can set up the measurements that you display using pop-up menus. Pop-up menus appear in the active tile. In general, they control only settings specific to the active tile. For example, the pop-up menu for the Waveform display enables you to specify the Display Mode.

The pop-up menu will appear when called (see procedure that follows), unless it is not appropriate for the current setting of the waveform rasterizer (for example, trying to display the Gamut menu when viewing a composite input signal).

1. Display the measurement in one of the four tiles as explained in *To Select a Measurement* on page 22.
2. Push and hold the tile button for the measurement that you displayed in step 1.
3. When the menu pops up, navigate it and make your selections as described in the steps that follow.

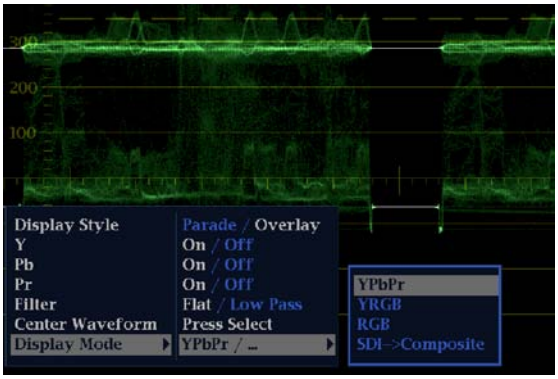


4. Use the right and left keys to traverse between menu panels. The instrument surrounds the panel selected with a blue border.
5. Use the up and down arrow keys to select parameters in a menu.
6. Press **SEL** to set the selected parameter.




The WFM pop-up menu with display mode set to YPbPr is shown.

***NOTE.*** *The selections in a pop-up menu can change depending on settings.*

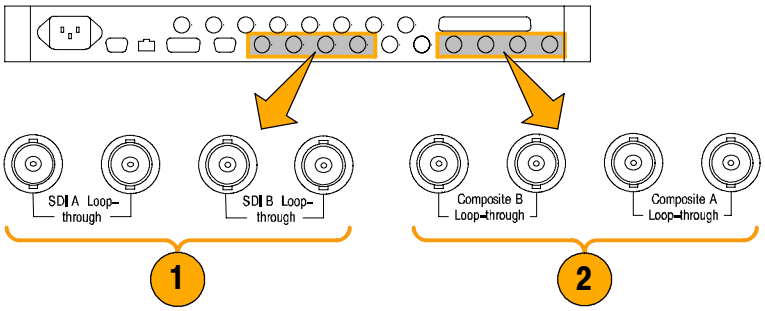


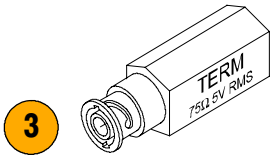

# To Select Among Inputs

You can connect SDI (Serial Digital Interface) signals and select them for display. Depending on the rasterizer model and options installed, you can also connect high-definition component, standard-definition component, and analog composite signals.

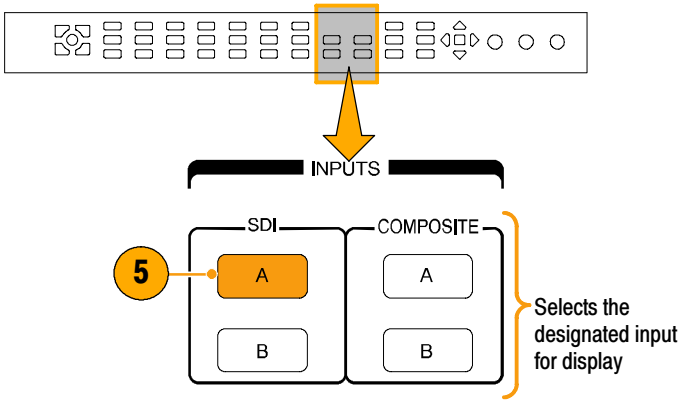
## To select an SDI input

1. Connect any digital component video signals to the A and B SDI inputs at the rear panel:
   - WVR7100: If Option SD is installed, the instrument automatically detects whether input is HD or SD; otherwise connect HD signals only.
   - WVR6100: Connect SD signal only.
2. Connect any analog composite signals to the A or B Composite inputs at the rear panel. (On Option CPS equipped instruments only.)
3. Terminate the loop through input properly at the rear panel for any inputs that you connected.



4. Press the button corresponding to the input that you want (SDI Input A shown).
5. Select a tile and measurement in which to display the input.

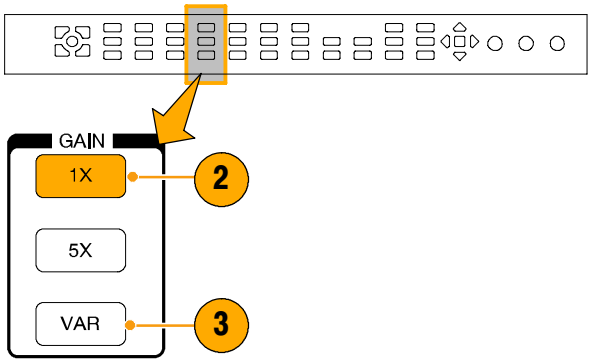



## To Set Gain and/or Sweep

Each tile maintains its own settings independent of the other tiles. These settings include GAIN and SWEEP, and Display Type (among others). For instance, when you switch a tile to a different measurement, the GAIN and SWEEP settings will be changed to what they were the last time the selected measurement was displayed in the tile. As the procedure below indicates, GAIN and SWEEP do not apply to all display types.

### To set Gain:

1. Select a tile and a measurement (see *To Select a Measurement* on page 22 if you need help).
2. If GAIN is selectable, one of the GAIN buttons will be lit; otherwise select a measurement that supports GAIN selection, such as WFM. Push the button for the GAIN setting that you want.
3. If you push VAR(iable), set the gain that you want using the GENERAL knob.



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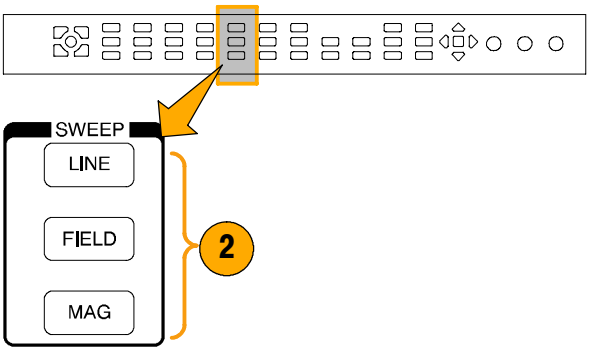
## To set Sweep:

1. If SWEEP is selectable, one of the SWEEP buttons will be lit; otherwise select another measurement that supports SWEEP selection, such as WFM.
2. Push the button for the SWEEP setting that you want.
   - LINE—Sets the active tile to the current Line rate sweep or 2 Line sweep
   - FIELD—Sets the active tile to the current Field rate sweep or 2 Field sweep
   - MAG—Sets the active tile to Variable Gain. Gain is set using the GENERAL knob.
3. Repeat steps 1 and 2 until you've selected measurement displays for all tiles that you wish to define.



# To Use Presets

Presets let you save up to five custom setups for later recall. You can also recall a factory predefined setup.

## To recall the Factory preset

1. Push the FACTORY button.

   The front panel setup will revert to default factory settings.

## To save as setup to a preset

2. Set up the instrument as you want it.
3. Push and hold the button of the numbered preset in which to store the current instrument setup. (Preset 1 shown.)

   The setup will be stored for later recall.

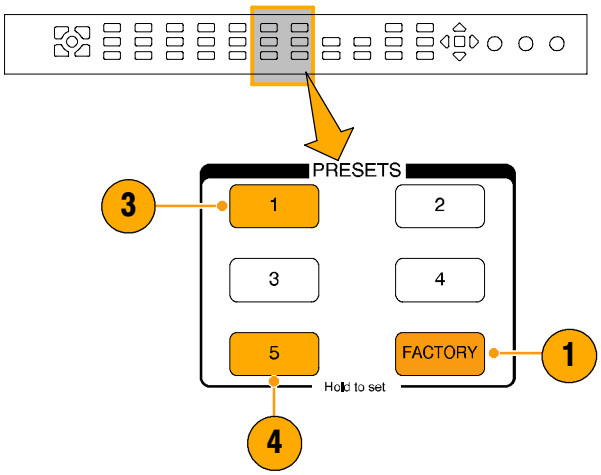
## To recall an existing preset

4. Push the numbered button for the preset you wish to recall.

   The front panel setup will switch to the saved preset corresponding to the button pressed.

## To clone a setup between rasterizers

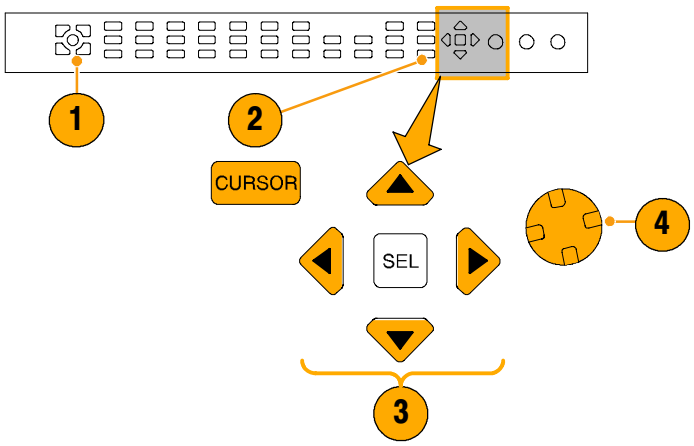
You can store presets as files on a PC and upload them to any rasterizer. See *Cloning Setups (Presets)* in the *WVR6100 and WVR7100 User Technical Reference* (found on the *User Documents CD*) for more information.



# To Measure Waveforms with Cursors

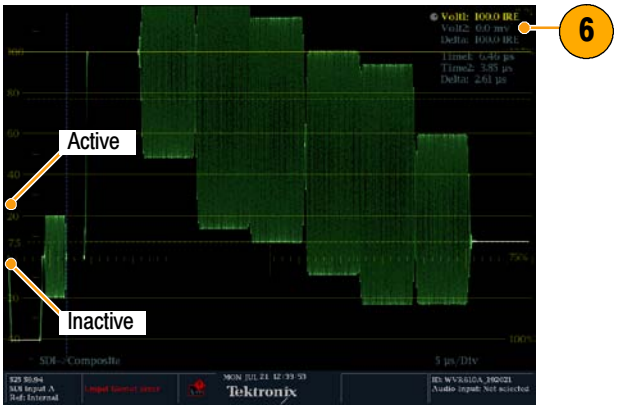
Cursors enable you to measure time or voltage on a waveform. Cursors appear only in a tile set to Waveform mode. If the active tile is not in Waveform mode, then an error message is displayed.

## To display and adjust cursors



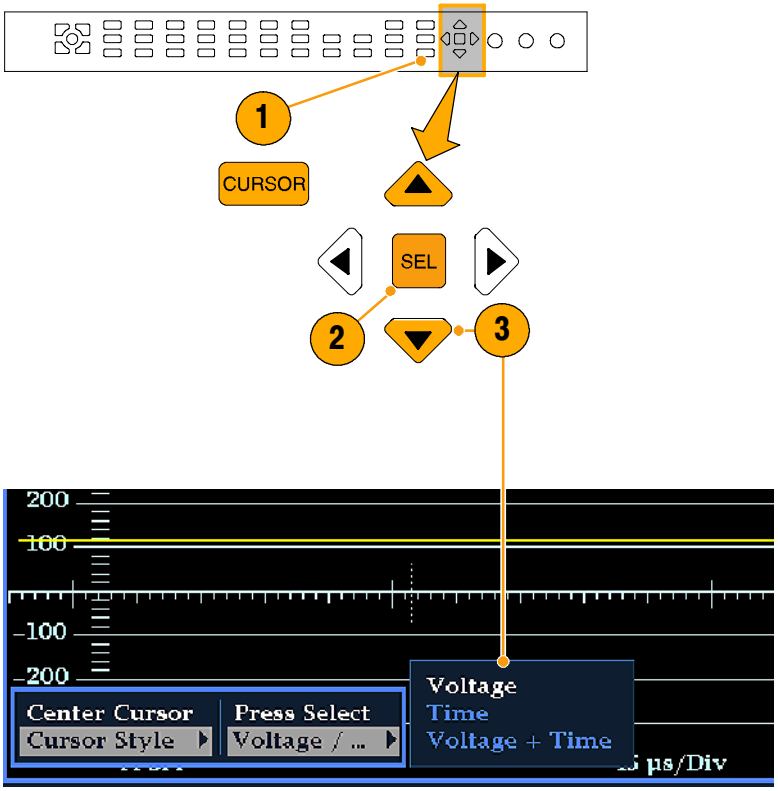

1. Choose a tile that is currently displaying a waveform.
2. Push the CURSOR button to display the cursors on the selected tile. (Pushing CURSOR again turns cursors off.)
3. Push the arrow keys to select the active cursor:
   - If Voltage OR Time cursors are displayed, press any arrow key to select active cursor.
   - If Voltage AND Time cursors are displayed for the voltage cursors, press either the up or down arrow key, and for time cursors, press either the left or right arrow key to change the active cursor.
4. Turn the general knob to adjust the selected cursor on the waveform. Active cursor readout appears in yellow with knob icon.

   **Tip.** To quickly center the active cursor on screen, press and hold the SEL button.
5. Repeat steps 3 and 4 to adjust the other cursor.
6. Read the cursor measurement in the Cursors readout.



## To switch among cursor types

1. Press and hold **CURSOR** to display the Cursor pop-up menu.
2. Select **Cursor Style,** and press **SEL** to change the focus to the submenu.




3. Select the desired cursor type using the up/down arrow keys. The three styles of cursors available are:
   - **Voltage** - display the voltage level at each cursor and the voltage difference between the two cursors.
   - **Time** - display the position of each cursor relative to the start of the sweep and the difference between the two cursors.
   - **Voltage + Time** - displays both the Voltage and Time cursors.

## Usage Tips

If you use other functions, such as Line Select, while cursors are active, the knob will be assigned to those other functions. Press **CURSOR** to transfer the knob control back to cursors.

You can display independent cursors in all four tiles at the same time.

Cursors track the live trace, so they may not be correctly registered on a frozen trace.

Cursors can be used with the Eye Display (Option EYE or PHY only) to measure electrical characteristics of an SDI signal; see *How to Monitor the SDI Physical Layer* on page 51 for more information.

For cursor measurements, you can use any gain setting, including variable gain (the waveform and the cursors are equally affected). Higher gain settings help match the cursor to the waveform.

# To Freeze the Display

Pushing the **FREEZE** button captures the current image for traces (waveform, gamut, and vector), picture, status, and audio measurements, if selected. Freeze is useful for comparing sources or for capturing transient events. Press **FREEZE** to capture a display you wish to keep or show to someone else. In this application, the **Frozen Only** display mode may be best. For comparing sources, the **Frozen + Live** display mode is useful. To use this feature, select one source, press FREEZE to capture an image, then select the second source and compare.

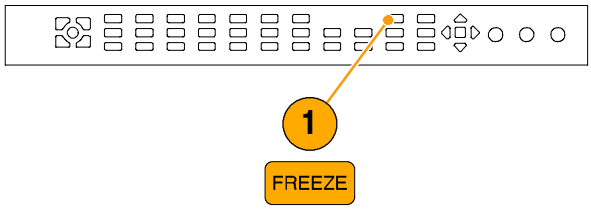
Not all displays react identically to freeze. WFM displays capture a trace. For text displays, such as Status, pressing FREEZE halts updates to the display. This allows you to view the different status displays without numbers or status readouts changing. The waveform rasterizer continues to log error status in the background while the display is frozen.

FREEZE works in both tile and full-screen modes, but frozen images do not change from tile to full or full to tile. That is, if you freeze a trace in tile mode, the frozen image will not be shown if you go to full-screen mode. The frozen image will still be available if you go back to tile mode. Likewise, if you freeze a Waveform image in a tile and then switch the tile to another measurement such as Vector, the frozen waveform image will be hidden. If you then change the tile back to Waveform, the frozen image will reappear.

For waveform displays, the frozen image is shown in a different color to distinguish it from the live image.

## To halt display update:

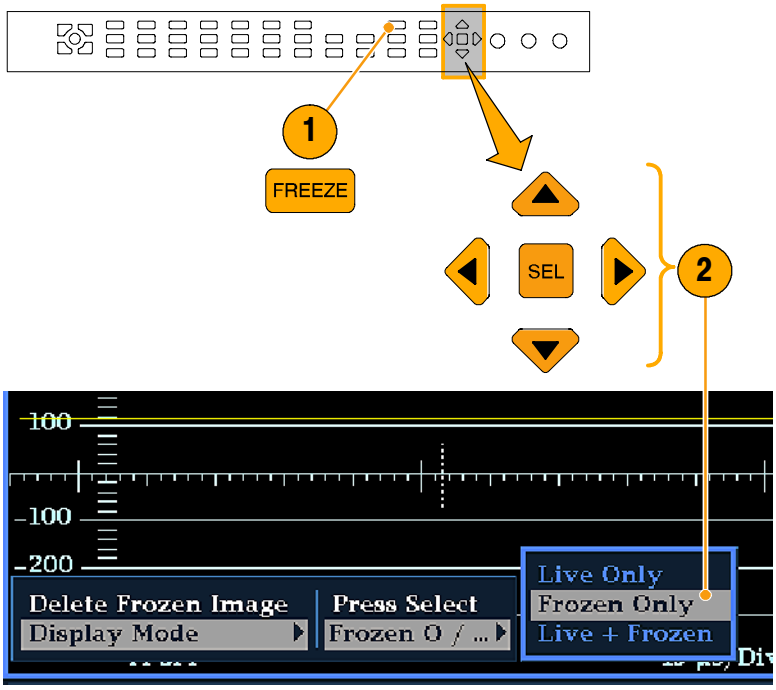
1. Push the FREEZE button. For most displays, updates stop.




## To select the FREEZE display mode:

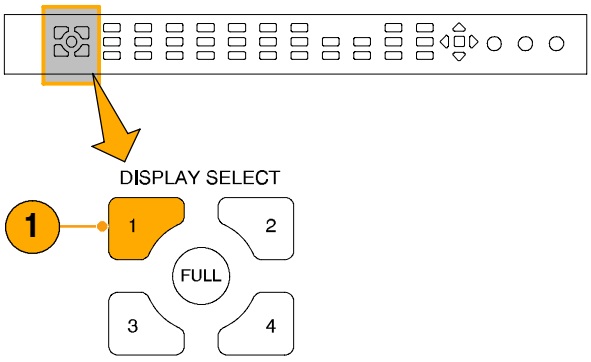
1. Push and hold **FREEZE** to display the pop-up menu.
2. Use the navigation keys to select the desired mode, and then press **SEL** to set the FREEZE display mode:
   - **Live Only** allows you to keep a frozen image, but not display it.
   - **Frozen Only** allows you to see artifacts in the frozen trace more easily.
   - **Live + Frozen** allows comparisons and matching. (STATUS and AUDIO displays do not support this mode.)

***NOTE.*** *The display mode chosen is specific to the tile selected, and can be set independently.*

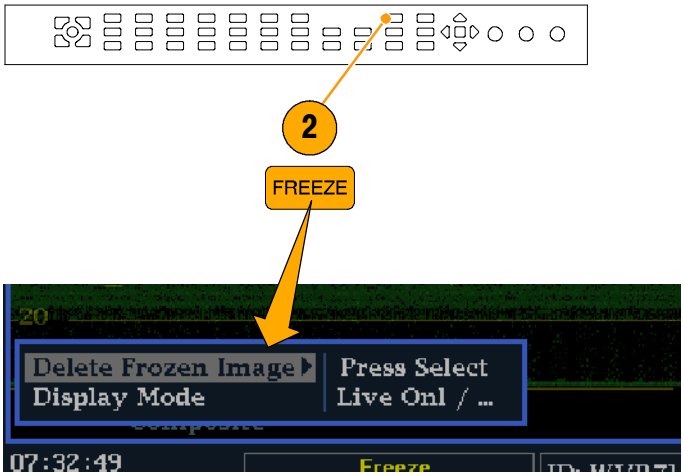


## To delete the FREEZE display:

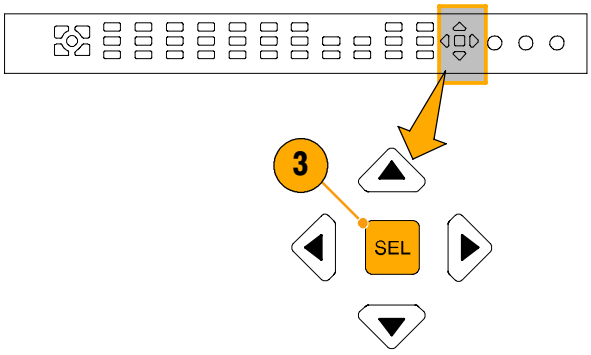
1. Select the display tile for the frozen display that you want to delete.




2. Push and hold **FREEZE** to display the pop-up menu. **Delete Frozen Image** will be already selected.




3. Press **SEL** to delete the frozen image. The pop-up menu is automatically removed from the display when the frozen image is deleted.




## Usage Tips

FREEZE can be configured to act on only the active tile or on all tiles. To change the FREEZE from Active Tile to All Tiles, you must go to the *Display Settings* Configuration menu.

Cursors track the live trace, so they may not be correctly registered on a frozen trace. If you change parameters such as position, sweep rate, or gain, then the cursors may not be accurate relative to a frozen trace.

# To Set Line Select Mode

## To Toggle Line Select Mode

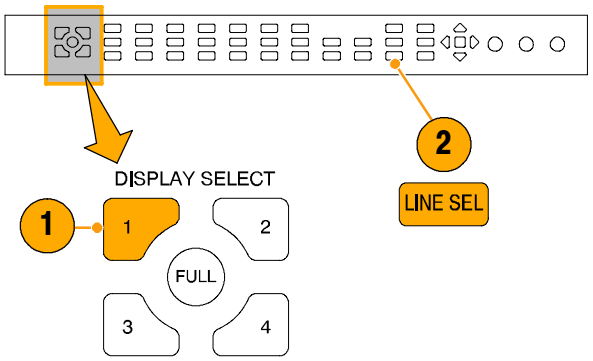
1. Select the tile containing the display for which you want to set Line Select Mode.

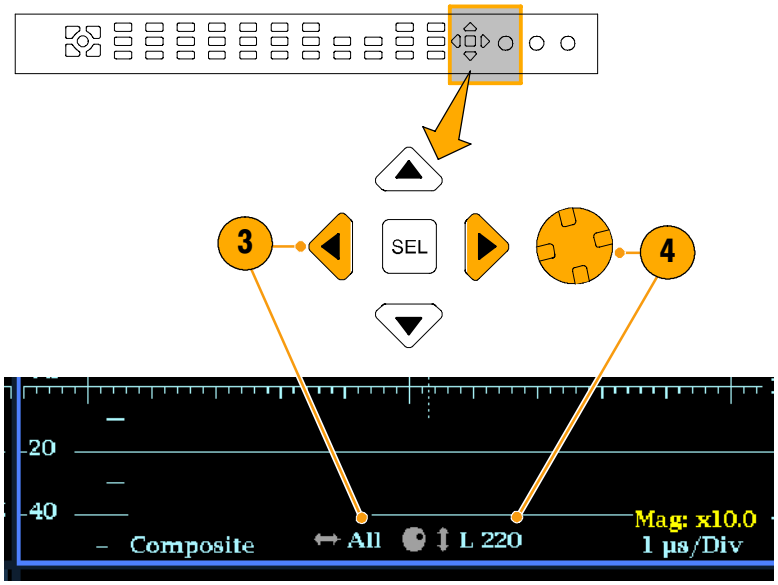
   ***NOTE.*** *Line Select Mode can only be active on one tile at a time, but the line select brightup cursor does appear in other tiles, and moves as you select lines in the active tile.*

2. Push **LINE SEL** to toggle Line Select Mode on or off. When on, the tile displays the selected line information only. The Line selection menu appears at the bottom of the selected tile.

3. Press the left or right arrow key to select F1 (field 1), F2 (field 2), F3 (field 3), F4 (field 4), or All.

4. Turn the GENERAL knob to select the line you want to view.



# To Configure Your Instrument

The Configuration menu is used to change the settings of the waveform rasterizer that are changed only occasionally or settings that are not specific to a tile, such as printer settings. To change a setting, you must highlight the desired setting:

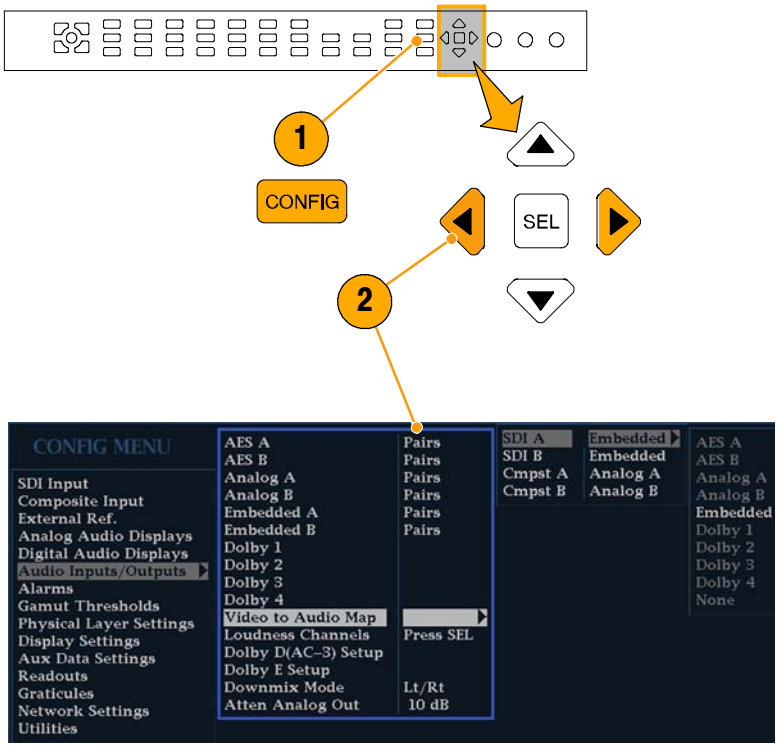
## To Traverse the Menu Panes:

1. Press the CONFIG button to display the Configuration menu.

   The Configuration menu is displayed on the top or bottom half of the screen opposite the active tile.

2. Use the left/right arrow keys to move the selection back and forth among panels.

   The selected, active pane is boxed by a blue line.



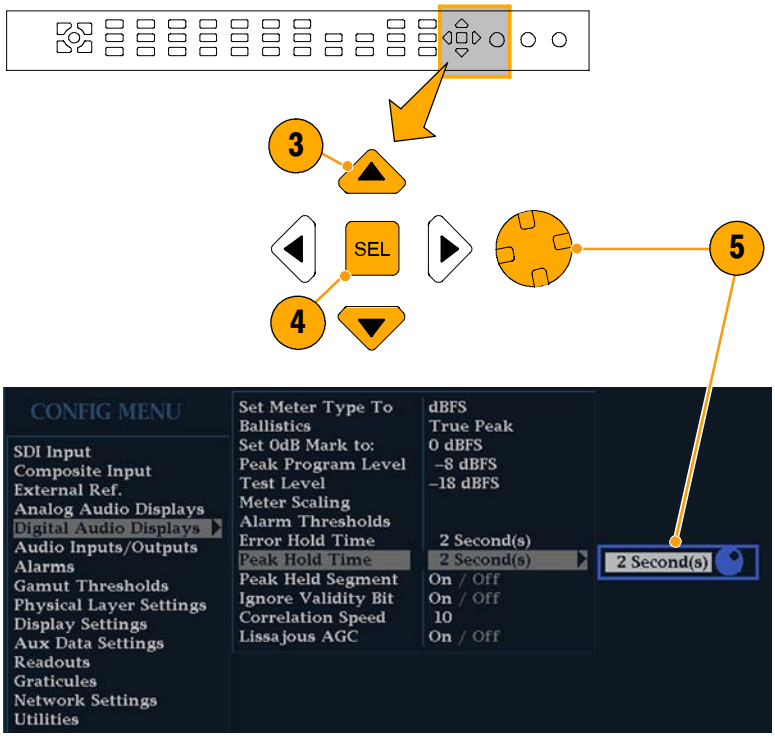

## To Select/Adjust a Parameter:

3. Use the up/down arrow keys (or the General knob) to move the selection up and down the menu entries in the selected pane.

   The selected, active menu item is highlighted by a white menu bar; the selected item in unselected menus highlighted by a blue menu bar.

4. Push the SEL key (or right-arrow key) to toggle between parameter settings. For example, if Peak Held Segment was highlighted at right, pushing SEL toggles between On and Off settings.

5. If the menu item selected results in the knob icon appearing in the menu, use the General knob to adjust the selected parameter.



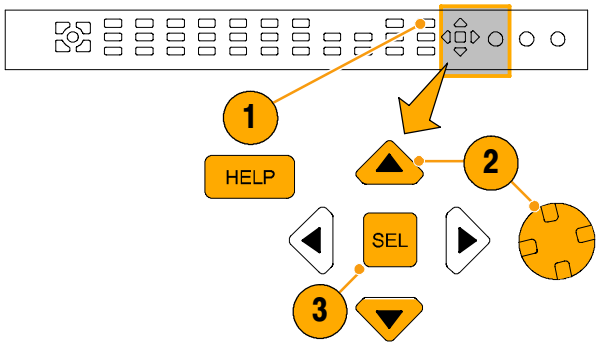
# To Use Online Help

The WVR6100 and WVR7100 online help is both a quick reference to instrument operation, and the exclusive reference for the details of instrument operation. The online help is:

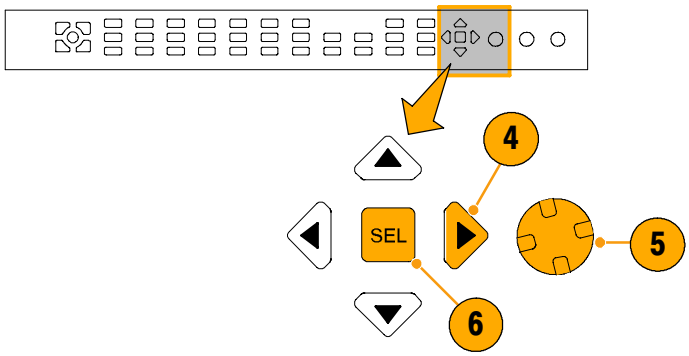
- Context-sensitive, where the topic displayed depends on what is displayed in the active tile when the online help is selected, or what control is operated after help is selected.
- Navigable, with the Contents and Topic Selector panes, along with Links within the topics, providing access to topics.

## To display and navigate online help:

1. Press **HELP**.
2. Use the **GENERAL** knob or the up / down arrow keys to highlight a entry in the Contents (entries never change).
3. Press **SEL** to select the the highlighted category.



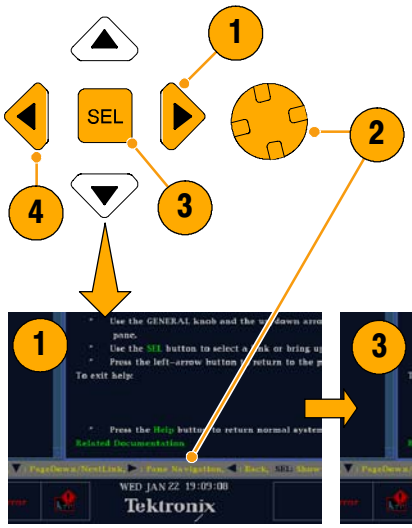

4. Press the right-arrow key to move selection to the Topic Selector pane (entries change with the selection made in steps 2 and 3).
5. Use the **GENERAL** knob and the up / down arrow keys to select among the topics listed for the heading selected in step 2.




6. Press **SEL** to display the selected topic.

## To follow a link within a help topic

1. Press the right-arrow key to move selection to the Topic pane.
2. Highlight a link using the GENERAL knob or the up / down arrow key.
3. Press **SEL** to jump to the linked-to topic.
4. Press the left-arrow key to go back to the previous topic.

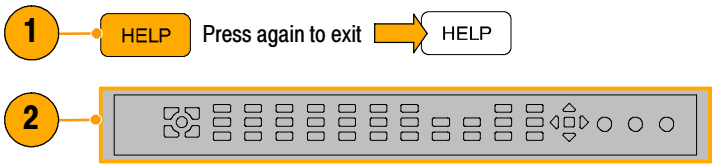



## To get context sensitive help:

1. When you want help on the control or setting you are using now, press **HELP**.

   If you displayed a menu in the active tile, and select a menu setting, help on that setting displays.

2. Now operate (press, select, turn) a control that you need help with. The help topic pane displays help on the control you used.




## To exit the online help:

1. Press **HELP** to extinguish the button.

***NOTE**. You can also access online help on a computer networked to the rasterizer. See* Remote Communication *in the* WVR6100 and WVR7100 User Technical Reference (located on the User Documents CD) *for more information on using the Web Browser from the remote Java Applet or Application.*

# How to Time a Studio

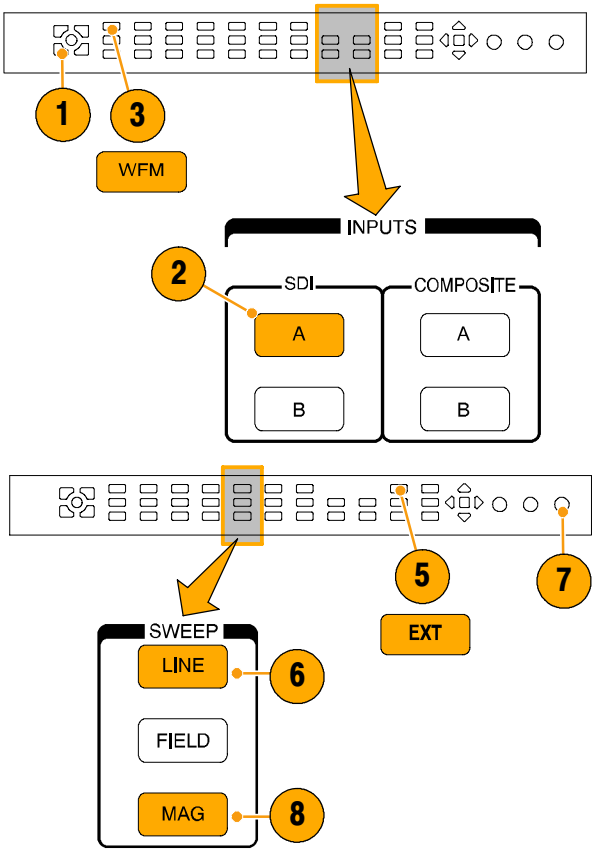
Timing a studio involves adjusting the references going to different sources so that their output feeds have the same timing when they arrive a common point, such as a production switcher. For digital systems, the timing typically only needs to be close, because most switchers have some tolerance to timing errors. For analog composite systems, the timing may need to be matched within a small part of a subcarrier cycle to prevent hue shifts when switching between sources.

The waveform rasterizer supports multiple methods and techniques of timing a studio. All of these methods require an external reference to the waveform rasterizers. The methods and techniques follow.

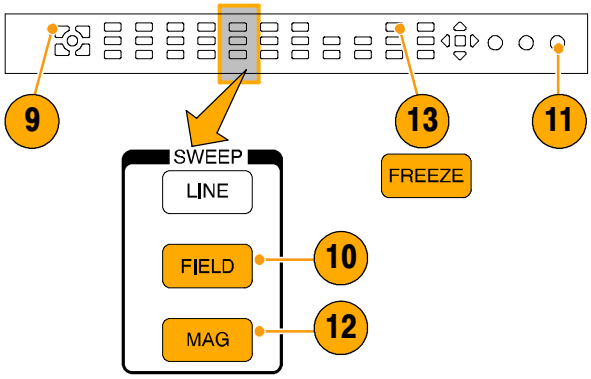
## To Use the Traditional Method

This instrument makes the traditional method of comparing Horizontal and Vertical timing easier by providing flexible tiles and the FREEZE function. To time a studio using the traditional method, you store an input as a baseline and compare signals that you time against the baseline.

1. Select a tile in which to time the active input. Select WFM.
2. Apply the first input signal to the appropriate input, terminate it properly, and select it. (See *Line Termination* on page 9 for termination information.)
3. Push and hold WFM. Select a display mode from the Pop up menu that is appropriate to the signal that you input.
4. Apply the house reference signal to the external reference input, terminating it properly.
5. Press **EXT** to select External Reference mode. (Connected to the house reference.)
6. Put the selected tile in line mode.
7. Use the **HORIZONTAL** knob to center the sync edge or the SAV pulse. (If using the SAV pulse, turn off Stripping EAV/SAV/ANC in the SDI Input settings of the CONFIG Menu.)
8. Press **MAG** to increase the timing resolution.



9. Select a second tile.
10. Press **FIELD** to put a second tile in field mode, choose an appropriate waveform mode.
11. Use the **HORIZONTAL** knob to center the vertical interval.
12. Press **MAG** to increase the timing resolution.
13. Press **FREEZE** save the waveform as a baseline.
14. Apply an input that needs to match timing of the first input.
15. Adjust the timing offset of the signal being timed to match the timing to the saved baseline.
16. Repeat steps 14 and 15 for any other required signals.




***NOTE**. Use the Cursors as markers or to measure timing differences between sources.*

In this procedure, other tiles can be used to set fine timing and check color frame alignment on composite signals. Alternatively, the other two tiles could be used for line and field rate displays without Mag active to show the location of significantly mis-timed signals.

## To Use the Timing-Display Method

The Tektronix proprietary Timing Display (patent pending) provides a quicker, easier to use measure of the timing of an input relative to the external reference:

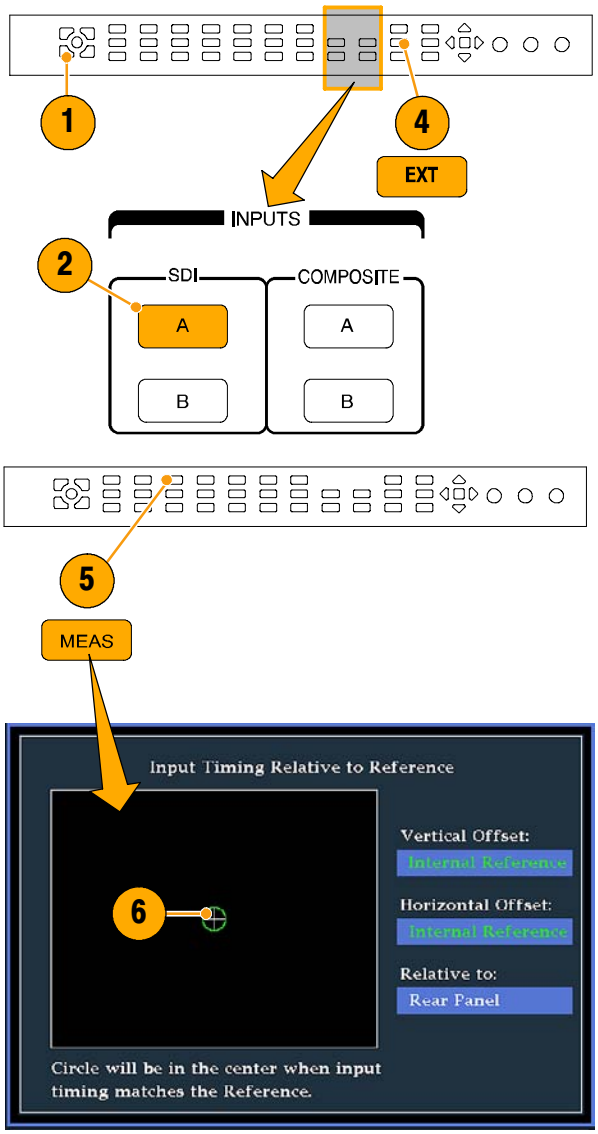
- The rectangular display automatically scales to match the input signal. For progressive signals the display represents one field, for interlace signals the display represents one frame, and for composite inputs the display represents one color frame.
- The cross-hair in the center represents zero offset, and the circle represents the timing of the input signal. Lines of advance or delay are shown as vertical displacement, while timing errors of less than one line are shown as horizontal displacement. If the input is at the same time as the reference, then the circle will be centered on the cross-hair.
- The timing offset is also shown numerically as lines and micro-seconds of advance or delay in the boxes at the right side of the display.
- For input and reference signals with closely related frame rates, there is only one timing relationship, so a single circle is shown on the display to indicate the timing offset of the input signal.
- For input and reference combinations with more complex relationships, multiple circles are displayed to indicate all the possible interpretations of the timing offset, with the one that is closest to zero shown with emphasis. The numerical readouts will correspond to the timing indicator circle with the emphasis.

- The Relative to: box indicates the chosen zero point for the timing display. The default is Rear Panel. In this mode, the offset is zero when the input and reference are at the same timing at the rear panel of the waveform rasterizer. The other choice is Saved Offset. In this mode, you can save the timing from one signal and then display the timing relative to that saved offset.

## To use the Timing display to time a signal to a reference:

1. Select a tile in which to time the active input.
2. Apply the input signal to be timed to the appropriate input, terminate it properly, and select it. (See *Line Termination* on page 9 for termination information.)
3. Apply the house reference signal to the external reference input, terminating it properly.
4. Press **EXT** to select External Reference mode.
5. Press **MEAS** to select the Timing display for the tile selected in step 1.
6. If only one circle is displayed, adjust the timing offset of the black generator to match the timing to the external reference. Adjust for a perfect coincidence of the circle around the reference target (circle turns green at coincidence) and null values of the vertical and horizontal timing readouts.
7. If multiple circles are displayed, the timing is complex, and you must choose the one you want. The measurement that is closest to zero offset is displayed with emphasis and appears in the readouts.

   ***NOTE.*** *See* Timing Displays for Simple Versus Complex Timing *in the* WVR6100 and WVR7100 User Technical Reference *for more information about complex timing displays and their elements.*
8. Repeat step 6 or 7 for any other signals.



***NOTE**. As you adjust timing, the circle representing the input timing may jump occasionally. This is because the color frame detection circuit can be temporarily disrupted as the signal shifts. The jump is often a multiple of the field time. The circle will settle back to the correct location in a second or so.*

### Usage Notes

- The resolution of the timing display for Composite and SD signals is one 27 MHz clock cycle or 37 ns. For HD signals, it is one clock at 74.25 MHz, which equates to about 13.5 ns. To get the greater accuracy needed for a composite signal, first use the timing display to get close, then use a vector display for the final burst phase alignment. Since the waveform rasterizer can display both the timing display and a vector display simultaneously (each in its own tile), this process can still be easy and quick.
- For composite signals the definition of time aligned is obvious but for an SDI input relative to a analog reference the situation is more complex. For the timing display, the definition of zero offset on an SDI input uses the methodology described in SMPTE RP168. This method specifies the SDI signal will be converted to analog. The converted analog signal is then compared to the analog reference. For the conversion, a D/A converter with delay of about three microseconds is used.
- In the relative to rear panel mode, this three microsecond conversion delay is accounted for in the displayed offset. In the Relative to Saved Offset mode, it has no effect.

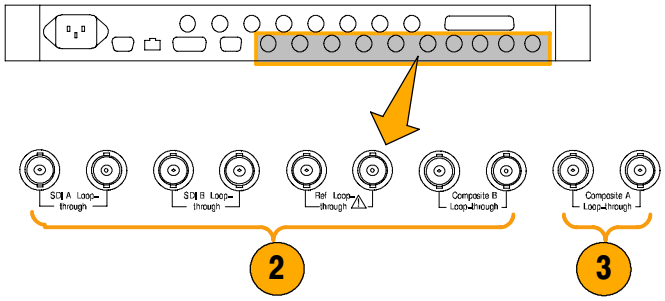
## To Time Multiple Inputs to a Router

You can also use the Relative to: function to set the offset between a master signal and a reference signal as the zero-point reference for time-down applications. The **Relative to**: box indicates the chosen zero point for the timing display:

- **Rear Panel**. In this mode (default), the offset is zero when the measured signal input and reference are at the same timing at the reference at the instrument rear panel. This setting was used in the Timing Display Method procedure.
- **Saved Offset**. In this mode, you can save the timing from a master signal relative to the reference as the zero point offset. Then route other inputs and measure relative to this saved offset.

### To time the inputs to a router:

1. Perform steps 1 through 5 of the procedure starting on page 38, with the qualifications described in steps 2 and 3 that follow.
2. Route the signal you want as the master to the appropriate input, SDI or Composite, and terminate properly.
3. Route the reference signal to the reference input and terminate appropriately.



4. Save[1] the timing offset for the master input (**MEAS** > **Save Offset** > **Press Select**) and select **Relative to: Saved Offset** mode from the pop-up menu.

5. Now select other inputs to the router to be connected to the waveform rasterizer. For each input the relative timing will be displayed.

6. Adjust the timing offset at the master sync source to time down the inputs to the router to match the master.

1 You cannot save the timing offset if either the input or reference is missing or unlocked. You also cannot save a reference when in internal mode. Saving an offset in these conditions would lead to misleading results so it is not allowed by the instrument. A warning message will appear on the screen if you attempt to save the offset when it is not allowed.

## Usage Notes

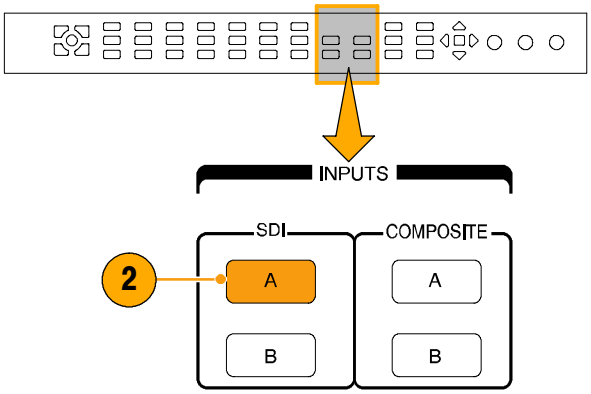
- The resolution of the timing display is one 27 MHz clock cycle or 37 ns, for Composite and SD video. To get the greater accuracy needed for a composite signal, first use the timing display to get close, and then use a vector display for the final burst phase alignment. Since these two displays can be present simultaneously in separate tiles, this process is still easy and quick.
- For composite signals, the definition of time aligned is straight forward, but for an SDI input relative to an analog reference, the situation is more complex. For the timing display, the definition of zero offset on an SDI input assumes the SDI signal will be converted to composite. The converted composite signal is then compared to the analog reference. For the conversion, a half-band filter with a 33 clock-cycle delay and an analog reconstruction filter are assumed. This conversion introduces a delay of about 3 μs.
- In the **Relative to: Rear Panel** mode, this 3 μs conversion delay is removed from the measured offset before the display is generated. In the **Relative to: Saved Offset** mode, it has no effect.
- This timing relationship between input and reference is also compatible with the waveform mode. That is, if you have zero timing on the Timing display and change from internal to external reference, the displayed waveform will not shift position.
- When timing analog composite signals, adjust the system phase with the Vector display. The Vector display is described in *Timing Displays for Simple Versus Complex Timing* in the *Supplemental Operating Information* chapter of the *WVR61000 and WVR7100 User Technical Reference*.

***NOTE.*** *If you have an input and reference combination that requires multiple timing indicator circles, then it can be misleading to compare timing offsets between multiple inputs. Because the timing display chooses the smallest of the possible timing offsets, if a large timing difference exists between two inputs, then they may not be matched. This problem will also occur using traditional timing methods unless one uses something similar to the SMPTE318 10 field flag to identify a specific sub-multiple of the reference.*

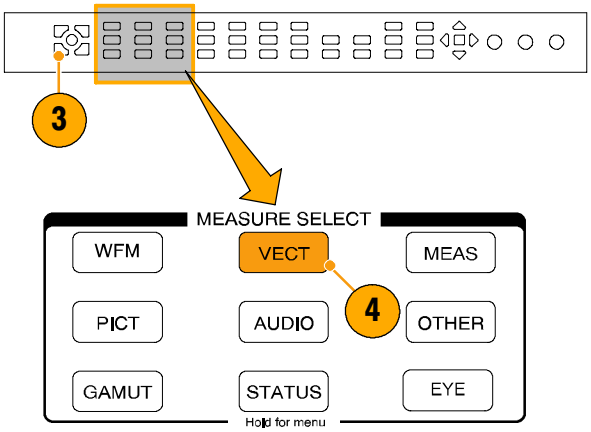
# How to Check Chroma/Luma Delay (Lightning Display)

The Lightning display can be used for interchannel timing measurement. If the color-difference signal is not coincident with luma, the transitions between the color dots will deviate from the center mark of a delay scale. The amount deviated represents the relative signal delay between luma and color-difference signal.

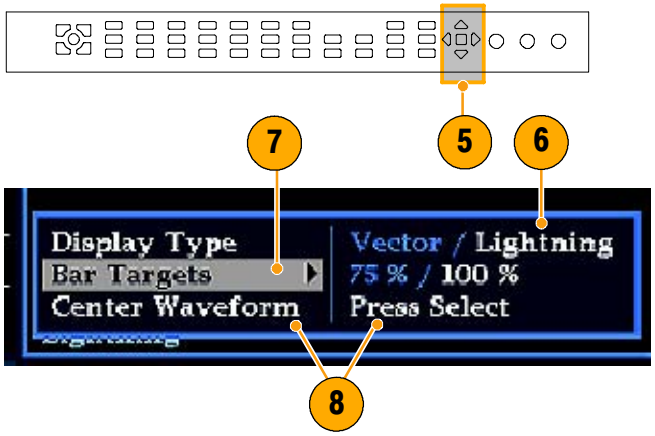
1. Connect a signal containing color bar information, terminating the signal properly (see *Line Termination* on page 9 for termination information).
2. Select the input corresponding to the signal connected.




3. Select a tile.
4. Press and hold the VECT button to display the signal in a tile and pop up the Vector menu.




5. Use the Selection Keys and Button to set the menu in the steps that follow.
6. If Display Type is Vector, select Lightning in the menu.
7. Set Bar Targets to match your input signal.
8. Select Center Waveform, and press SEL if you want center your waveform.
9. Press the VECT button to close the menu.



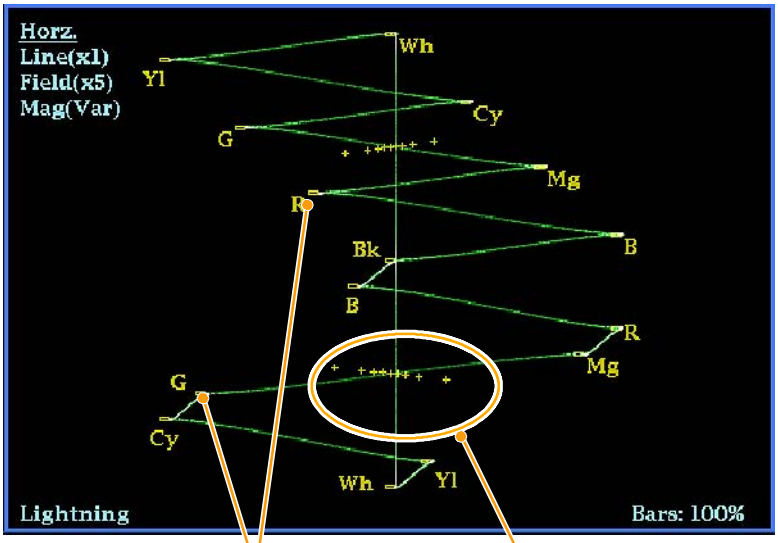
**10.** Determine where transitions intersect the delay scales and derive the timing error in nanoseconds, as deflected from center mark:

| Deflection | SD | HD |
|---|---|---|
| 0 marks | 0 ns | 0ns |
| +/-1 mark | 20 ns | 2 ns |
| +/-2 marks | 40 ns | 5 ns |
| +/-3 marks[1] | 74 ns | 13.5 ns |
| +/-4 marks[2] | 148 ns | 27 ns |

**[1] 1 Luma sample**

**[2] 1 Chroma sample**

- The center mark of the nine marks spanning each green-magenta transition is the zero error point.
- Alignment to a mark towards black means the color-difference signal lags with respect to luma.
- Alignment to a mark towards white means the color-difference signal leads the luma signal.
- The upper half of the display measures the Pb to Y timing; the bottom half measures the Pr to Y timing.




Green-to-Magenta transitions

Delay scale

# How to Check Gamut

Signals that are legal and valid in one signal representation may not be legal in another representation. Specifically, signals which are legal in the Digital YCbCr representation may not be legal if transcoded to RGB or encoded to NTSC / PAL. Any signal that fails this test is considered out of gamut.

The waveform rasterizer supports multiple displays and alarms to allow detecting out of gamut signals. The flexible tile display allows you to simultaneously view several of the gamut measurements to learn which is most appropriate for a given application. The displays are:

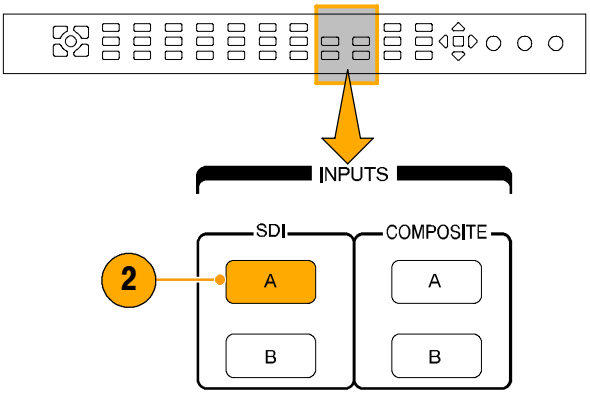
- Diamond for checking that SDI signals conform to legal RGB gamut space
- Split Diamond separates the upper and lower diamonds to show excursions below black, otherwise it is identical to the Diamond display
- Arrowhead for checking if an SDI signal is legal for composite color space
- Composite Waveform modes for checking both SDI and composite signals for legality in composite color space

Diamond, Split Diamond, and Arrowhead have adjustable thresholds. If the signal goes outside the area defined by the thresholds, the signal is out of gamut. If these limits are exceeded then the waveform rasterizer can generate alarms if configured to do so. For composite waveforms, the legal limit is simply the maximum level allowed for the combination of luma and chroma. This limit depends on the application. For example, a video tape machine may be able to record and play out signals with higher luma and chroma components that a transmitter.

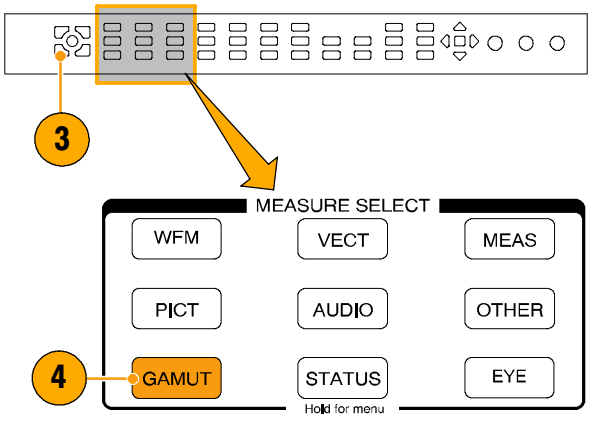
## To Set up for Gamut Checks

1. Connect a video signal and terminate it properly.

2. Select the input corresponding to the signal connected.



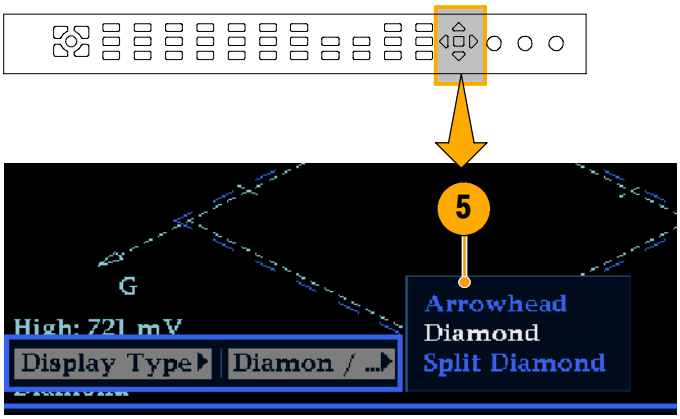
3. Select a tile.



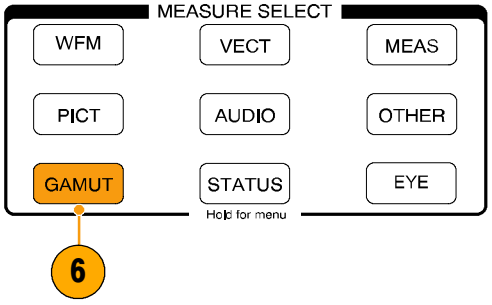

4. Press and hold the GAMUT button to display the signal in a tile and pop up the GAMUT menu.

5. Use the Arrow Keys and SEL Button to set the menu to one of these three gamut displays:

   - Diamond. Use to detect, isolate, and correct RGB component gamut errors.
   - Split Diamond. Use to reveal hard-to-find black gamut errors.
   - Arrowhead. Use to detect composite gamut errors, without employing a composite encoder.



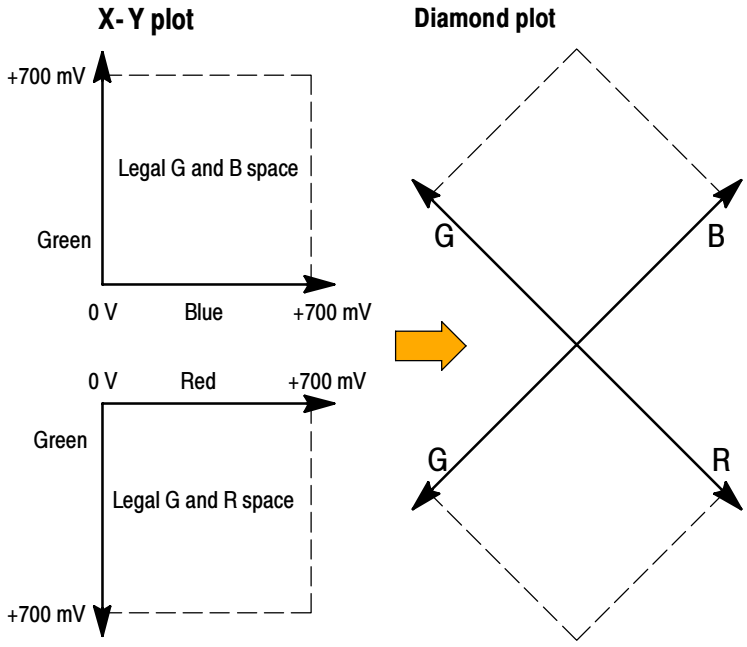

6. Press the GAMUT button to close the menu.



# To Check RGB Gamut

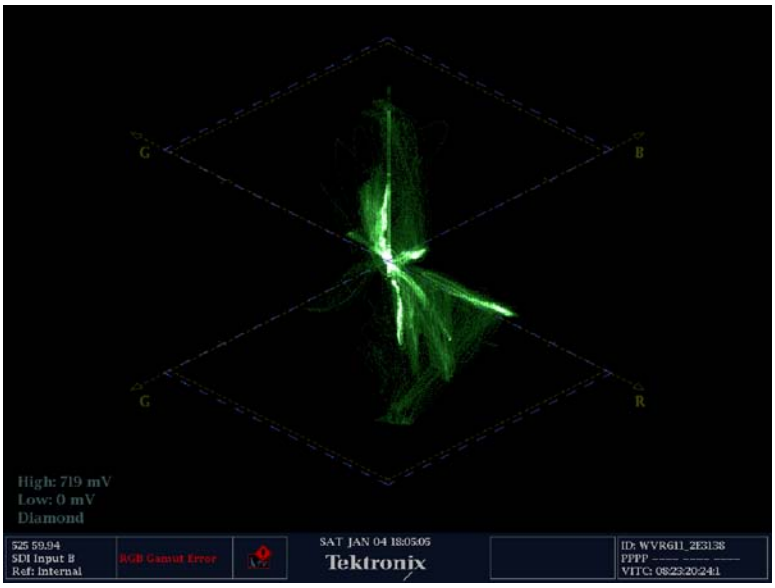
The Diamond display effectively shows how the R, G, and B signals relate, making it a good tool for detecting gamut errors. The waveform rasterizer converts the Y, $P_{b,}$ and $P_r$ components recovered from the serial signal to R, G, and B to form the Diamond display. To predictably display all three components, they must lie between peak white, 700 mV, and black, 0 V.

For a signal to be in gamut, all signal vectors must lie within the G-B and G-R diamonds. Conversely, if a signal vector extends outside the diamond, it is out of gamut. The direction of an excursion out of gamut indicates which signal is excessive. Errors in green amplitude affect both diamonds equally, while blue amplitude errors affect only the top diamond and red errors affect only the bottom diamond.



1. Perform the *How to Check Gamut* procedure that starts on page 43, selecting Diamond in step 5.
2. Compare the signal to the display to determine out of gamut components, noting the following:
   - The intensity of a vector indicates its duration.
   - A momentary out-of-gamut condition appears as a faint trace. Long duration violations show as a bright trace.

   See the following step for some sample out-of-gamut signals.

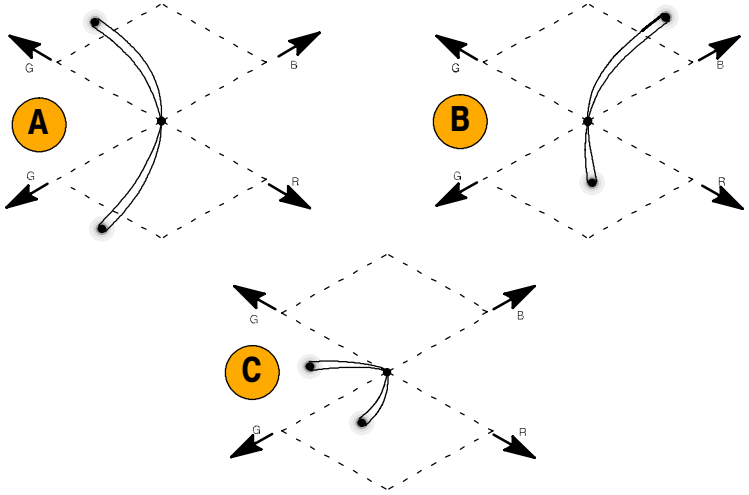



3. Consider the following examples when evaluating for out of gamut components:

   **A Example A:**
   R - Ok
   G > 700 mV
   B - Ok

   **B Example B:**
   R - Ok
   G - Ok
   B > 700 mV

   **C Example C:**
   R - Ok
   G - Ok, 350 mV
   B < 0 mV




## Usage Notes

As with the lightning display, bending of the transitions indicates timing delays. When a color bar signal is applied, the vertical axis becomes an indicator of delay errors.

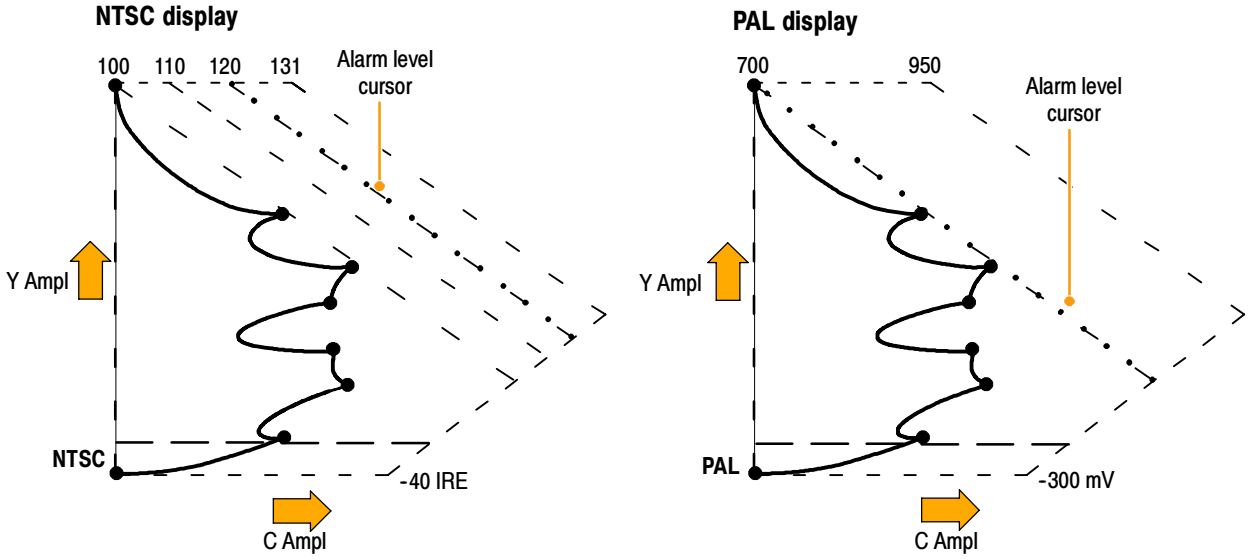
On the Diamond Display, monochrome signals appear as vertical lines. Nonlinear component processing, such as from a gamma corrector that alters white balance, can cause deviations along the vertical axis.

To isolate gamut bright-ups, try the following:

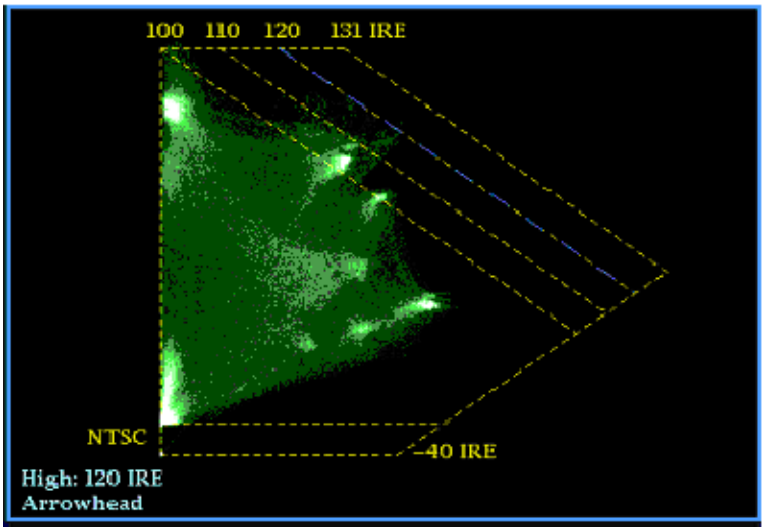
- Use LINE SEL to select individual lines
- Use PICT to examine the signal (turn on gamut bright-ups in the Display Settings submenu of the CONFIG menu)
- Use Arrowhead % setting (CONFIG menu, Gamut Thresholds submenu) to specify a percentage of the screen for which to ignore for gamut violations.

# To Check Composite Gamut

The Arrowhead gamut display plots luminance (Y) against chrominance (C) to check if the composite signal adheres to standard gamut. NTSC and PAL Arrowhead displays (75% Color bars) and indicates the values of the graticule lines. The arrow-head shape of the graticule results from overlaying the standard limits for luminance and luminance plus peak chrominance.




1. Perform the *How to Check Gamut* procedure on page 43, selecting Arrowhead in step 5.
2. Compare the signal to the display to determine out of gamut composite components, noting the following:
   - Signals exceeding the luminance amplitude gamut extend above the top horizontal limit (top electronic graticule line).
   - Signals exceeding the luminance plus peak chrominance amplitude gamut extend beyond the upper and lower diagonal limits.
   - The bottom horizontal line shows the minimum allowed luminance level of 7.5 IRE for NTSC and 0 mV for PAL.



### Usage Notes

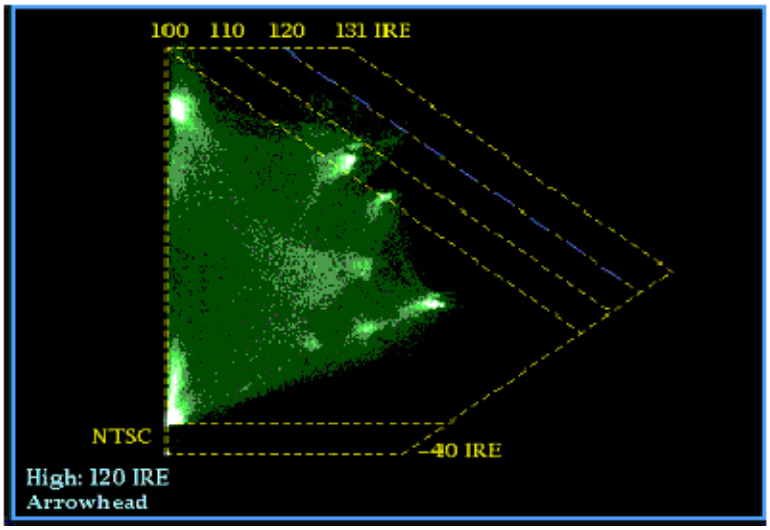
- To adjust the IRE level limits, do the procedure *To Adjust Gamut Limits* on page 50.
- To automate this check, do the procedure *To Automate Gamut Checks* on page 48.

## To Check Luma Gamut

Luma limit thresholds can be configured for identifying luma exceeding threshold limits. They apply to both the incoming SDI and to the arrowhead representation of the SDI input as a composite signal. By defining these levels in percent, they automatically account for the presence or absence of setup.

The thresholds are affected by your choice of set-up or no set-up for the Arrowhead display.

1. Perform the *How to Check Gamut* procedure on page 43, selecting Arrowhead in step 5.
2. Compare the signal to display to determine out of gamut luminance. Note the following:
   - The adjustable thresholds are indicated by the dark blue horizontal graticule lines.
   - The thresholds are defined in terms of percent of full scale.
   - The range for the Upper limit is 90% to 108%.
   - The range to the Lower Limit is -6% to +5%.

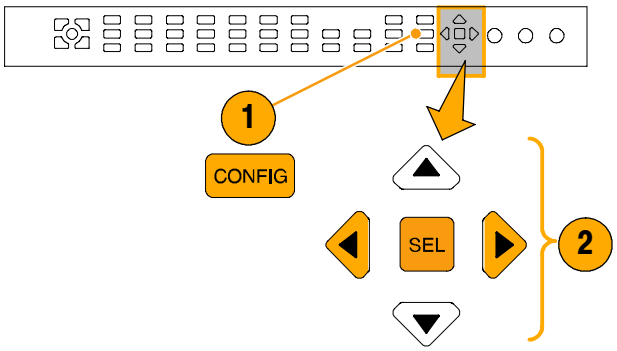



Another useful Arrowhead function is a measure of how well the active video signal is using the dynamic range of the video channel. A properly adjusted signal should be centered in the arrowhead graticule and have transitions that approach all the limits.

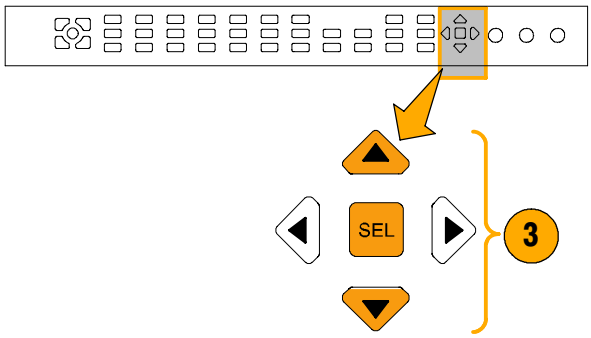
## To Automate Gamut Checks

You can use alarms to automatically monitor for out of gamut conditions:

1. Press the CONFIG button to display the Configuration menu.
2. Use the left/right arrow keys and SEL button to select Alarms, and then Video Content.



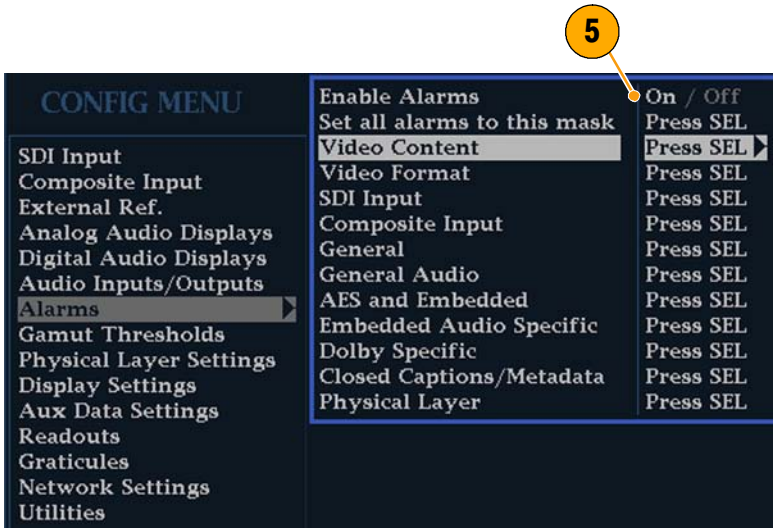
3. Use the up/down arrow keys to move to each the alarm that you want to set. Press SEL button to toggle the alarm on (X) or off.



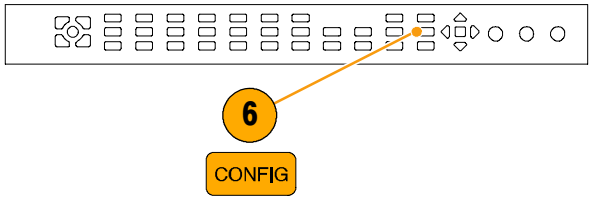

4. When you have configured the Alarms as you want them, move to the Select here.. box and select it.

5. Check that Enable Alarms is set to On in the Alarms menu before leaving the Alarms menu.

   ***Note**. For information on Alarms, press the HELP button while Alarms is selected in the CONFIG menu.*



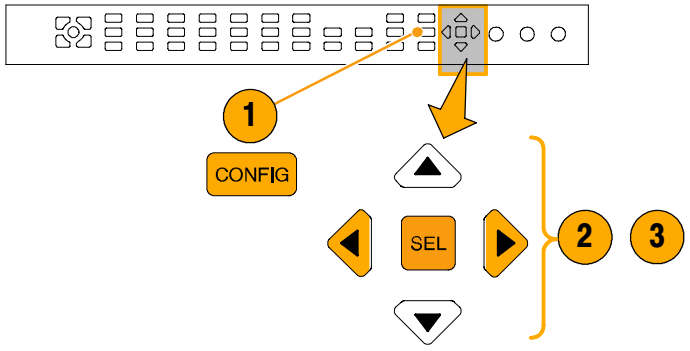

6. Press CONFIG to exit the menu.

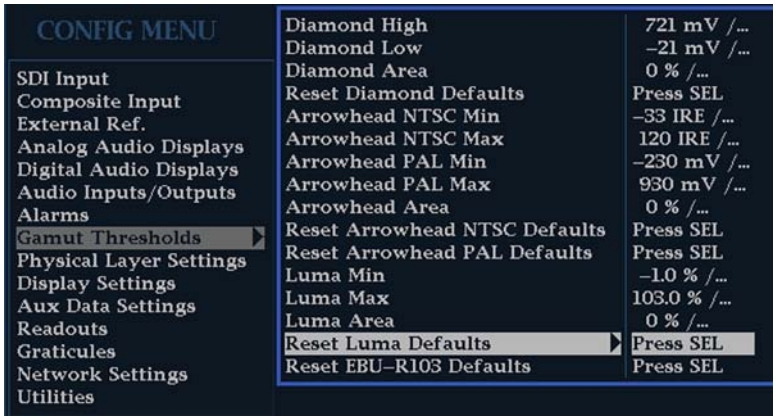


# To Adjust Gamut Limits

1. Press the CONFIG button to display the Configuration menu.
2. Use the left/right arrow keys and SEL button to select Gamut Thresholds.
3. Press SEL button to enter the sub-menu, and use arrow keys and SEL button (and General knob, when indicated) to select and set the various thresholds as you want them.

   Note that you can also reset thresholds to defaults.



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# How to Monitor the SDI Physical Layer

With Options EYE and PHY, the waveform rasterizer supports the checking, verification, and monitoring of the SDI physical layer in the following ways:

- Option EYE. If present, this option adds support for eye pattern monitoring of the physical layer of video signals. WVR6100 instruments display eye patterns for only SD signals. WVR7100 instruments display eye patterns for HD signals, and also for SD signals when Option SD is installed.

- Option PHY. If present, this option includes the Option EYE features and adds automatic eye measurements and a jitter waveform display to aid the monitoring of the SDI physical layer. WVR6100 instruments display jitter waveforms for only SD signals. WVR7100 instruments display jitter waveforms for HD signals, and also for SD signals when Option SD is installed.

With Options Eye and PHY installed, you can use the following display modes to monitor the SDI physical layer:

- Eye Display. On this display, you can use the voltage and time measurement cursors and their readouts to monitor amplitude and timing measurements on the Eye waveform. A jitter thermometer and readout displays the jitter magnitude. You can set the high-pass filter to allow measurement of different jitter types (timing and alignment). The jitter thermometer graphically relates the jitter measurement to the alarm limits. With Option PHY installed, you can use the Eye press-and-hold menu to access the Jitter waveform display.

  You can configure the instrument to show multiple Eye displays, each of which is controlled by one of the two jitter engines in the waveform rasterizer. The Jitter1 engine controls Eye displays in the top two tiles. The Jitter2 engine controls Eye displays in the bottom two tiles. The two jitter engines allows you to set different filter bandwidths in the upper and lower tiles so that you can monitor both timing and alignment jitter at the same time.

- Jitter Display. On this display, you can view additional time-domain information that is useful in separating sources of jitter, whether they are within a single circuit on a circuit board, or from various pieces of equipment in a system. The additional information includes the following:

  - Jitter components that are synchronous or nearly synchronous to video line or frame. These appear as stationary or near-stationary artifacts in line or field sweeps.

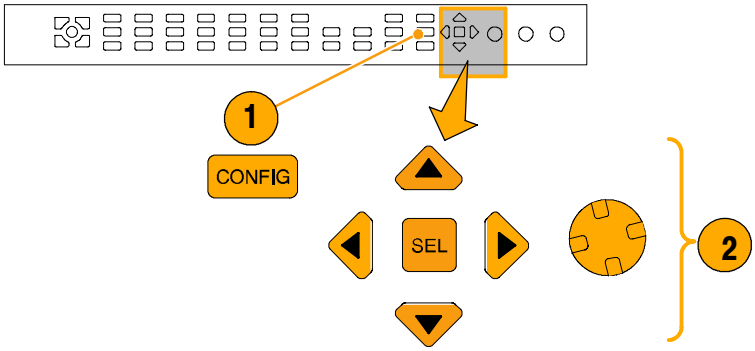
  - The wave shape of the jitter as modified by the high-pass filter setting.

- SDI Status Display. This display shows both the Jitter1 and Jitter2 thermometers described above. Additionally, a Cable Loss thermometer indicates the signal loss due to cable length. Use the CONFIG menu to configure the instrument for the cable type and length of your installation. With Option PHY installed, the SDI Status Display also shows the eye amplitude, eye risetime, eye falltime, and eye rise-fall delta measurement values.

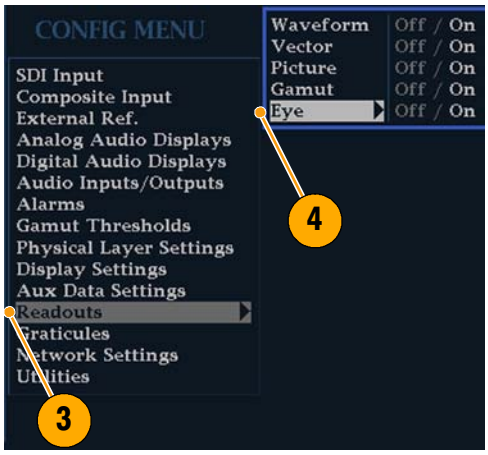
# To Configure the Physical Layer Settings

Before you use Eye or SDI Status displays to monitor the SDI physical layer, you should configure the eye and physical layer settings on the waveform rasterizer, as described on the following pages, for your monitoring needs. The eye and physical layer settings are initially set to FACTORY defaults, which you can restore using the FACTORY front-panel button.

1. Press the **CONFIG** button to display the CONFIG menu.
2. Use the selection (arrow) keys, the **SEL** button, and the **General** knob to make the menu selections in the steps that follow.



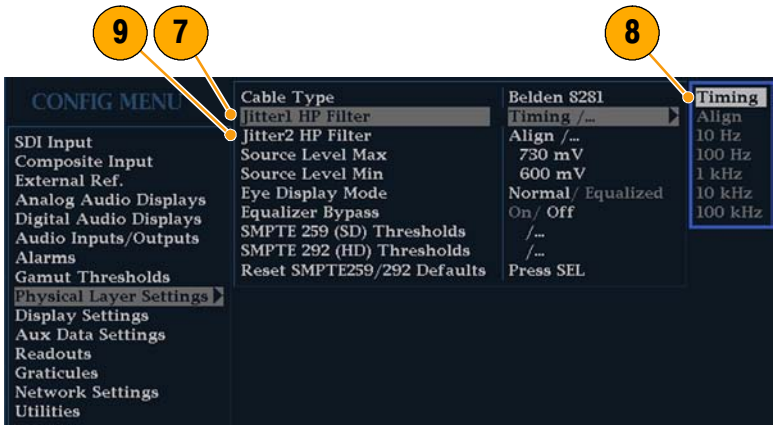

3. Select **Readouts**.
4. Set **Eye** to **On**.




5. Select **Physical Layer Settings**.
6. Select **Cable Type**, and select the best match for the type of cable that is connecting the SDI signal to the rasterizer.

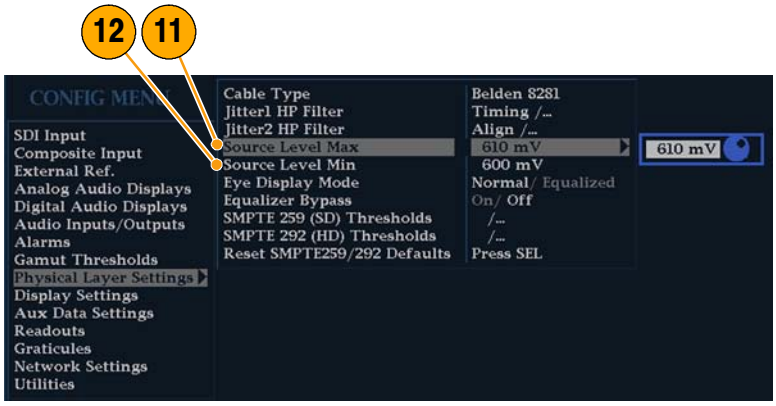
7. Select **Jitter1 HP Filter**.
8. Select a high-pass filter value for the Jitter1 engine controlling the top two tiles of the waveform rasterizer display.
9. Select **Jitter2 HP Filter**.
10. Repeat step 8 for the Jitter2 engine controlling the bottom two tiles.

    ***NOTE.*** *The Timing filter selection sets the filter value to 10 Hz. The Align filter selection sets the filter value to 1 kHz for SD or 100 kHz for HD.*

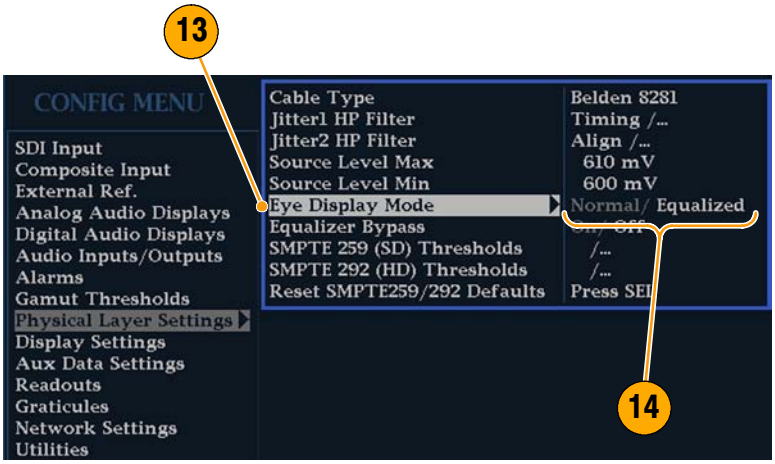



11. Select **Source Level Max**. Use the **General** knob to increase or decrease the setting.
12. Select **Source Level Min**. Use the **General** knob to increase or decrease the setting.

    ***NOTE.*** *The maximum value you can select is 1000 mV; the minimum value is 600 mV.*



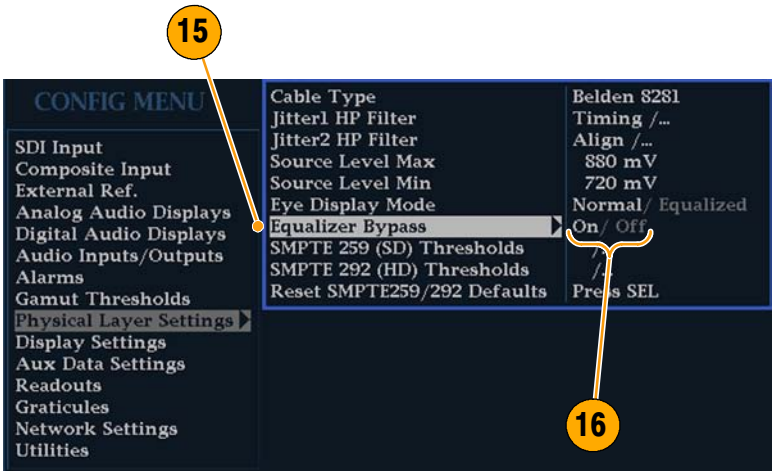

13. Select **Eye Display Mode**.
14. Select one of the following settings:
    - **Normal**. The Eye display shows the SDI input signal directly.
    - **Equalized**. The Eye display shows the SDI input signal after it has passed through the internal cable equalizer and comparator.



15. Select **Equalizer Bypass**.

16. Select one of the following settings:

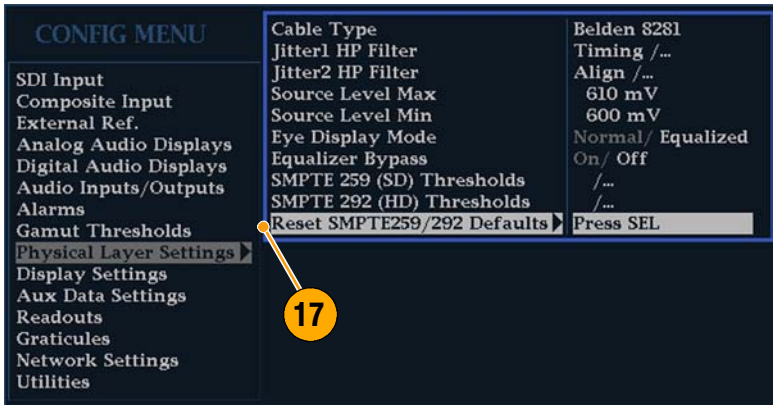
- **On**. Bypass the equalizer when the waveform rasterizer is connected to a signal with a short length of cable. This setting minimizes the jitter contributed by the internal equalizer and is generally used only with signals containing very low jitter.
- **Off.** Enables the equalizer, which enables operation with typical cable lengths and reduces jitter due to cable effects. Use this setting for most signals.




## To Set SMPTE 259/292 Alarm Thresholds

17. To reset both the SMPTE 259 (SD) and SMPTE 292 (HD) alarm thresholds back to the factory-default values, select **Reset SMPTE259/292 Defaults** and press **SEL**.

    ***NOTE.*** *The following thresholds only appear in the menu when Option PHY is installed: Eye Amplitude Max/Min, Eye Risetime Max/Min, Eye Falltime Max/Min, and Eye Rise-Fall Delta.*




18. To reset only the SD thresholds or the HD thresholds back to the factory-default values, select **SMPTE 259 (SD) Thresholds** or **SMPTE 292 (HD) Thresholds**, depending on which type of video signal you are monitoring.

19. Select **Reset Defaults** and press **SEL**.

    ***NOTE.*** *The steps and illustrations that follow show setting custom SD threshold values. The HD threshold names are the same as the SD thresholds, but the setting values and ranges may be different.*

20. To set custom threshold levels, select **SMPTE 259 (SD) Thresholds** or **SMPTE 292 (HD) Thresholds**, depending on which type of video signal you are monitoring.

21. Select **Jitter1 Level**. Use the **General** knob to increase or decrease the threshold level for the Jitter1 engine controlling the top two tiles of the waveform rasterizer display.

    The maximum level you can enter is 4.00 UI; the minimum level is 0.10 UI.

22. Select **Jitter2 Level**. Use the **General** knob to increase or decrease the threshold level for the Jitter2 engine controlling the bottom two tiles of the waveform rasterizer display.

23. Select **Cable Loss** to specify the threshold for signal loss (in dB) due to length of cable connecting the signal source to the waveform rasterizer.

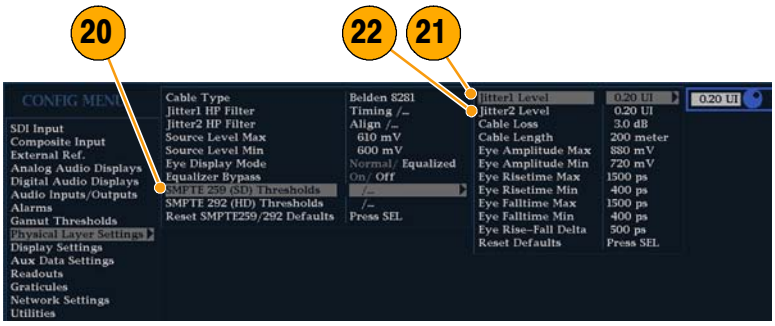
24. Use the **General** knob to increase or decrease the threshold level.

    The maximum level you can enter is 30.0 dB; the minimum level is 0.0 dB.

25. Select **Cable Length** to specify the threshold for the length of the cable (in meters) connecting the signal source to the waveform rasterizer.

26. Use the **General** knob to increase or decrease the cable length setting.

    The maximum length you can enter is 300 meters; the minimum length is 0 meters.



27. **Option PHY Only.** Select **Eye Amplitude Max**. Use the **General** knob to increase or decrease the setting.

    The maximum amplitude you can enter is 1010 mV ; the minimum amplitude is 700 mV.

28. **Option PHY Only.** Select **Eye Amplitude Min**. Use the **General** knob to increase or decrease the setting.

    The maximum amplitude you can enter is 10 mV below the current Eye Amplitude Max setting; the minimum amplitude is 530 mV.

29. **Option PHY Only.** Select **Eye Risetime Max**. Use the **General** knob to increase or decrease the setting.

    The maximum risetime you can enter is 3000 ps (SD) or 1000 ps (HD); the minimum risetime is 0 ps.

30. **Option PHY Only.** Select **Eye Risetime Min**. Use the **General** knob to increase or decrease the setting.

31. **Option PHY Only.** Select **Eye Falltime Max**. Use the **General** knob to increase or decrease the setting.

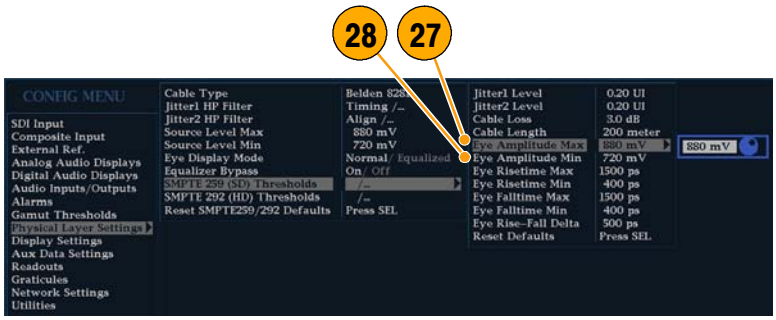
    The maximum falltime you can enter is 3000 ps (SD) or 1000 ps (HD); the minimum falltime is 0 ps.

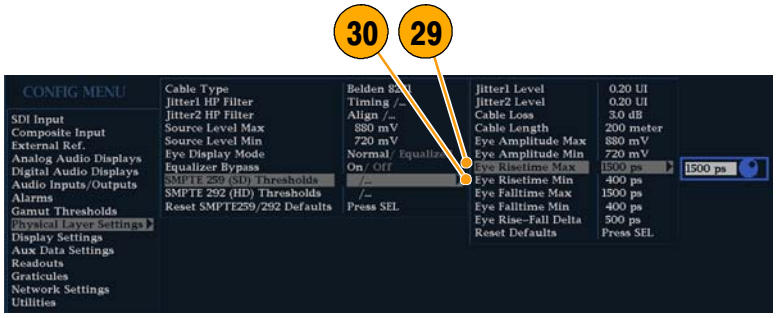
32. **Option PHY Only.** Select **Eye Falltime Min**. Use the **General** knob to increase or decrease the setting.

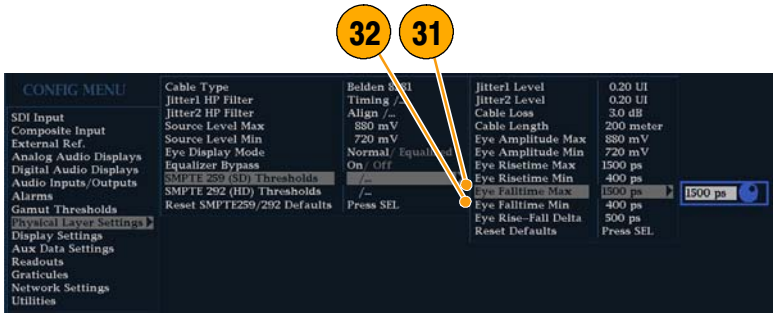
33. **Option PHY Only.** Select **Eye Rise-Fall Delta**.

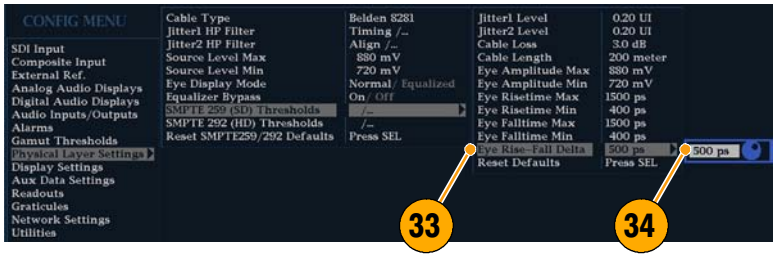
34. Use the **General** knob to increase or decrease the setting.

    The maximum value you can enter is 1000 ps; the minimum value is 0 ps.



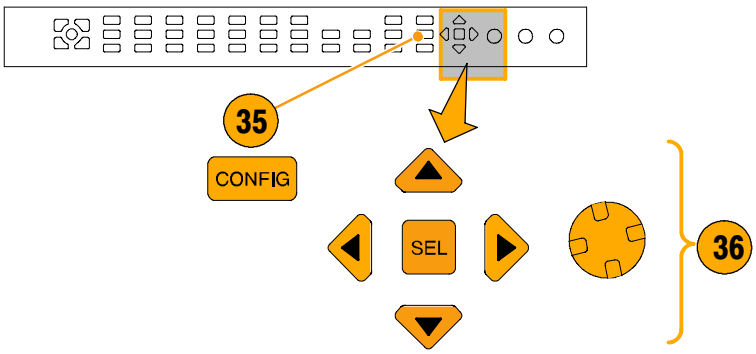



## To Configure Physical Layer Alarms

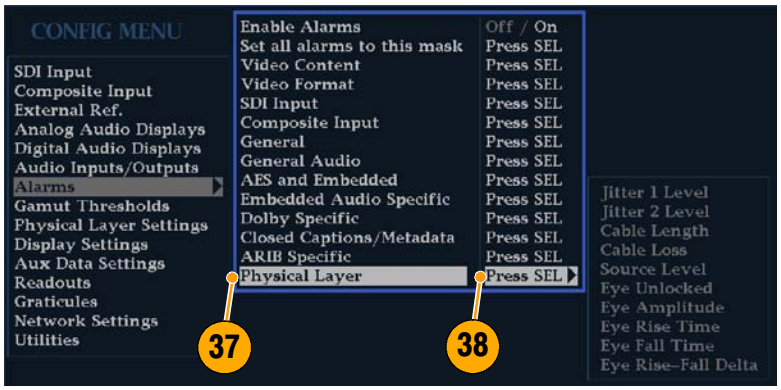
**35.** Press the **CONFIG** button to display the CONFIG menu.

**36.** Use the selection (arrow) keys, the **SEL** button, and the **General** knob to make the menu selections in the steps that follow.




**37.** Select **Alarms** and then select **Physical Layer**.

**38.** Press **SEL** and set the response type for each of the Physical Layer alarms. (See page 108, *How to Use Alarms*.)



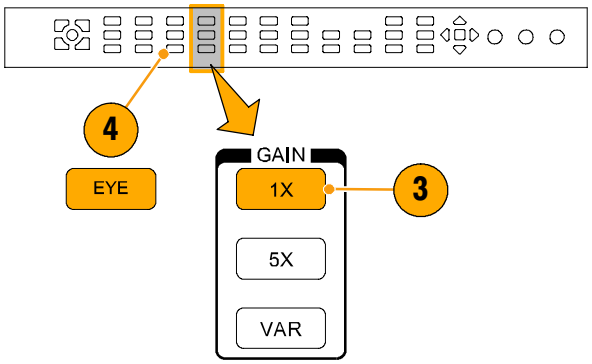
# To Take Eye Measurements

After you have configured the instrument for Eye measurements, you can use the cursors for manual waveform measurements or you can use the automatic eye measurements (Option PHY only).

***NOTE**. If present, use the EYE button to access the EYE display. If the Option EYE is installed on early instruments with no EYE button (or on the WFP Remote Front Panel if used), use the MEAS button to access the Eye Display by selecting Display Type > Eye Display in the Measure pop-up menu.*

## To Setup for Eye Measurements

1. Configure the waveform rasterizer to monitor the SDI physical layer. (See page 52.)
2. Connect a serial video-signal to the waveform rasterizer using a 75 Ω cable of two meters or less in length. Use high-quality, low-loss coaxial cable, such as Belden 8281.
3. Press the **EYE** button (or MEAS if no EYE button).
4. Press the **1X** vertical gain button.




## To Take Manual Eye Measurements

The procedures on the following pages describe how to take manual measurements of the Eye waveform. If Option PHY is installed, the instrument can also take automatic eye measurements. (See page 62.)

***NOTE**. If you use the measurement cursors to measure the eye waveform, you may measure a different result than that shown in the automatic eye measurements readout. This is because the automatic amplitude measurement uses histograms in order to be minimally affected by overshoot, ringing and noise on the signal. Similarly, the automatic risetime and falltime measurements use histograms to find the centers of the distributions of 20% and 80% crossings. The difference between manual and automatic measurements is usually insignificant for clean, symmetrical signals.*

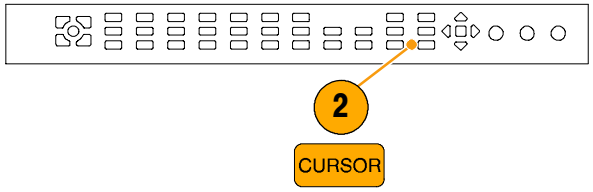
## Usage Notes

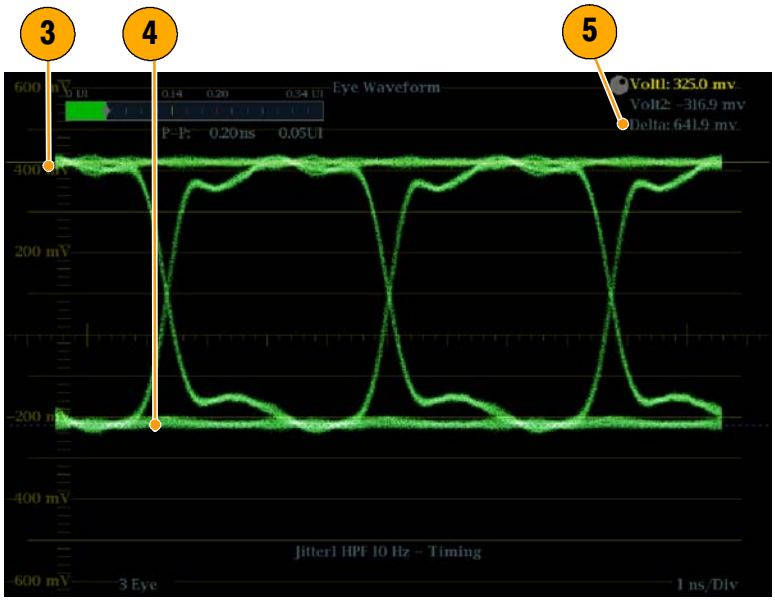
- Use the LINE SWEEP button to change the sweep of the Eye display.

## To Manually Measure Eye Amplitude

1. Perform the initial setup for Eye measurements. (See page 58.)
2. Press the **CURSOR** button to display the measurement cursors.
3. Position one voltage cursor at the top part of the waveform, ignoring any overshoot or undershoot on the rising or falling edges. (See page 28, *To Measure Waveforms with Cursors*.)
4. Position the second voltage cursor at the bottom of the waveform, ignoring any overshoot or undershoot on the rising or falling edges.
5. The Voltage Cursor readout displays the amplitude of the eye waveform.

   ***NOTE.*** *Signal-source amplitudes outside of ±10% of 800 mVp-p can degrade receiver performance.*

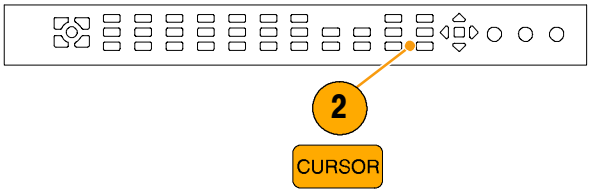


## To Manually Measure Aberrations

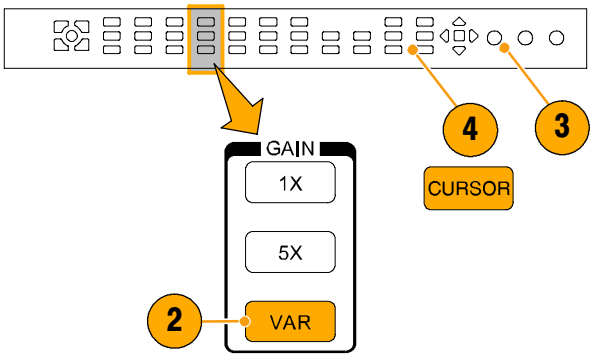
1. Perform the initial setup for Eye measurements. (See page 58.)
2. Press the **CURSOR** button to display the measurement cursors.
3. Position one voltage cursor at the peak of the overshoot at the top horizontal part of the waveform.
4. Position the second voltage cursor at the bottom of the top line of the waveform. Include any ringing (the oscillation following overshoot) in the measurement. Essentially, you are measuring the thickness of the top line of the waveform.
5. The Voltage Cursor readout provides the amplitude of the aberration.
6. Perform the same voltage-cursor measurement on the bottom line thickness, including any undershoot and ringing.

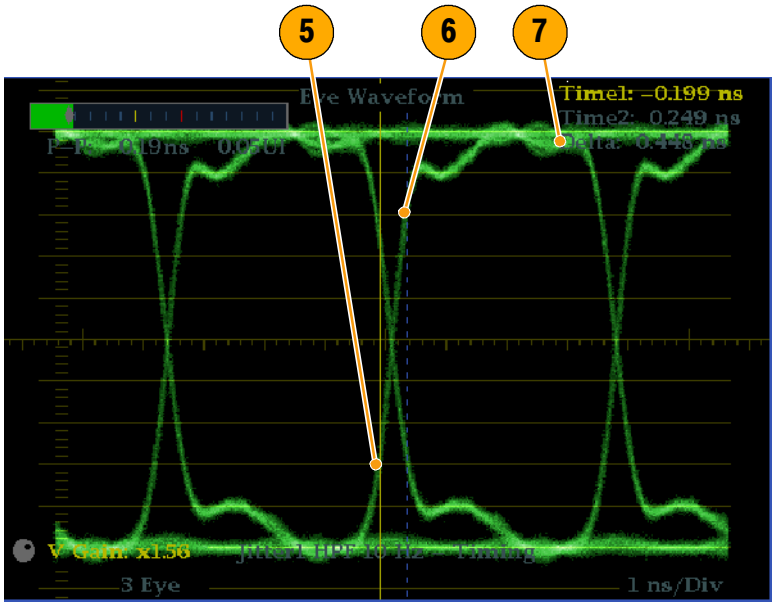
   ***Note.*** *Aberrations at the top or bottom line of the waveform should not exceed 10% of the signal amplitude. Automatic equalizer circuits in receivers may be sensitive to larger aberrations.*



## To Manually Measure Risetime Using Variable Gain

1. Perform the initial setup for Eye measurements. (See page 58.)
2. Press the **VAR** button to turn on variable gain.
3. Use the **General** knob to resize the waveform to 10 major divisions. Position the top and bottom of the waveform on graticule lines.
4. Press the **CURSOR** button to display the measurement cursors.
5. Position the first timing cursor at the crossing of the rising edge of the Eye waveform and the graticule line two divisions above the bottom of the waveform.
6. Position the second time cursor at the crossing of the rising edge of the Eye waveform and the graticule line two divisions below the top of the waveform.
7. The Delta time readout displays the 20 - 80% rise time measurement.

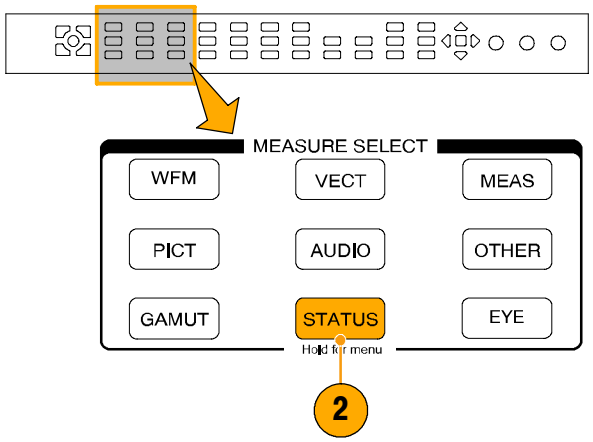


## To Take Automatic Eye Measurements (Option PHY Only)

The following procedure describes how to take automatic measurements of the Eye waveform when Option PHY is installed.

1. Perform the initial setup for Eye measurements. (See page 58.)
2. Press the **STATUS** button to select the Status display mode.
3. Press and hold the **STATUS** button to display the pop-up menu.
4. Select **Display Type** and then select **SDI Status**.




5. The SDI Status display contains readouts showing the automatic Eye waveform measurements.

   ***NOTE.*** *If you use the measurement cursors to measure the eye waveform, you may measure a different result than that shown in the automatic eye measurements readout. This is because the automatic amplitude measurement uses histograms in order to be minimally affected by overshoot, ringing and noise on the signal.*

   *Similarly, the automatic risetime and falltime measurements use histograms to find the centers of the distributions of 20% and 80% crossings. The difference between manual and automatic measurements is usually insignificant for clean, symmetrical signals.*

SDI Status
0 UI 0.14 0.20 0.34 UI
0 dB 2.10 3.0 5.10 dB
Jitter1 HPF: 100kHz
P-P: 0.25 ns 0.07 UI
Cable Loss (SD): 0.19 dB
Approx Cable (SD): 3 Meters
Source Level (SD): 776 mV
Cable Type: Belden 8281
0 UI 0.14 0.20 0.34 UI
Jitter2 HPF: 1 kHz Alignment
P-P: 0.25 ns 0.07 UI
Eye Amplitude: 787 mV
Eye Risetime: 826 ps
Eye Falltime: 785 ps
Eye Rise-Fall: 41 ps

# To Take Jitter Measurements

After you configure the instrument for Eye measurements, you can take jitter measurements using one of the following:

- Measurement cursors on the Eye display
- SDI Status display
- Jitter display (Option PHY only)

---

***NOTE**. Many jitter problems in systems have resulted from genlocking clocks to other references, such as the horizontal synchronization pulse. Reference jitter transferred by genlocks into a serial system is typically between 20 and several hundred Hertz. Also, the phase detection process used by the genlock can add noise, which results in jitter in the 10 Hz to 1 kHz range. Use the appropriate BW Limit filter selection to include or reject genlock jitter from a measurement.*

*Select the 10 Hz bandwidth filter to measure the total broadband jitter (use this setting if composite D/A conversion is planned).*

---

The simplest way is to measure jitter is to use the jitter readout. The jitter measurement readout and thermometer are derived from the jitter waveform, even when displayed in an Eye display. Those same readouts are also shown in the SDI Status display.

The Eye and Jitter waveform displays provide more qualitative jitter information. The Eye display shows the presence and magnitude of the jitter, and its potential for causing data errors as the eye closes. The Jitter display provides added time-domain information such as the following:

- Whether there are jitter components that are synchronous or nearly synchronous to the video line or frame (these components appear as stationary or near-stationary artifacts in line or field sweeps).
- The wave shape of the jitter.

By looking at jitter in both displays, you can separate the sources of jitter, whether they are within a single circuit on a circuit board, or from various pieces of equipment in a system.

Figure 1 shows the display of a signal with a lot of jitter. In the top two tiles, the high-pass filter is set for 10 Hz, so all jitter above 10 Hz is displayed. In the lower two tiles, the high-pass filter is set for 100 Hz, removing most of the 30 Hz jitter and leaving the spikes. Both Jitter displays are set for two-field sweep.

In Figure 1, the upper Eye display shows a fairly even jitter spread, suggesting a moderately uniform statistical distribution of jitter. This jitter is from a sine wave component; there is no indication of jitter spikes. In the lower Eye display, the jitter is more of a low-density haze suggesting a less uniform jitter distribution (as indicated from the spikes).

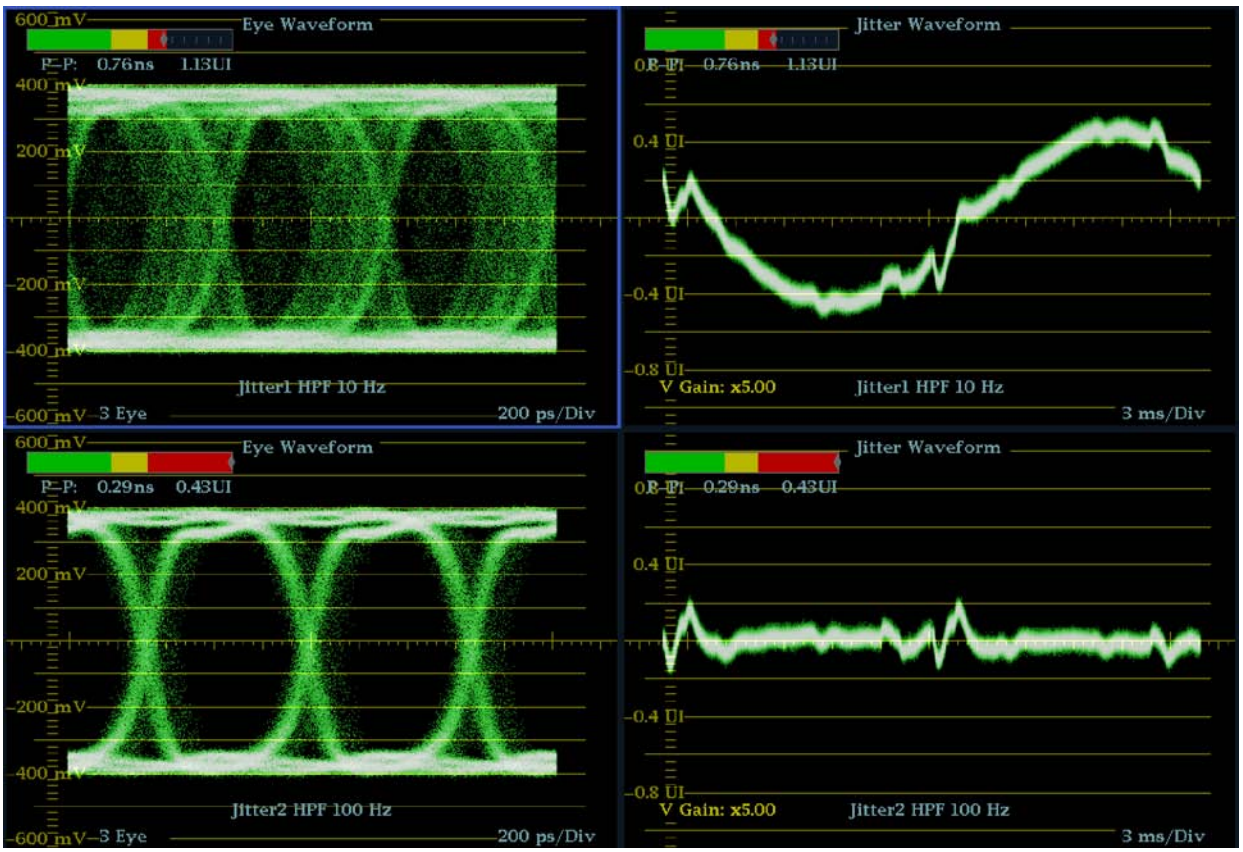


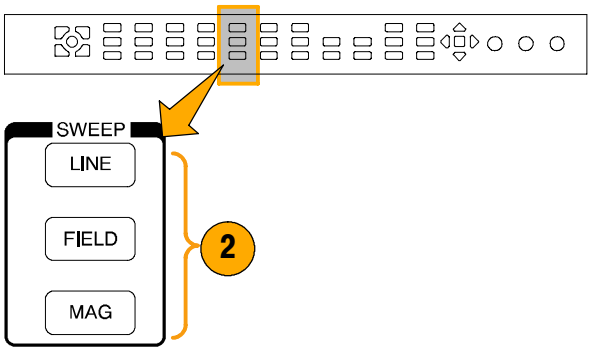

**Figure 1: Measuring jitter**

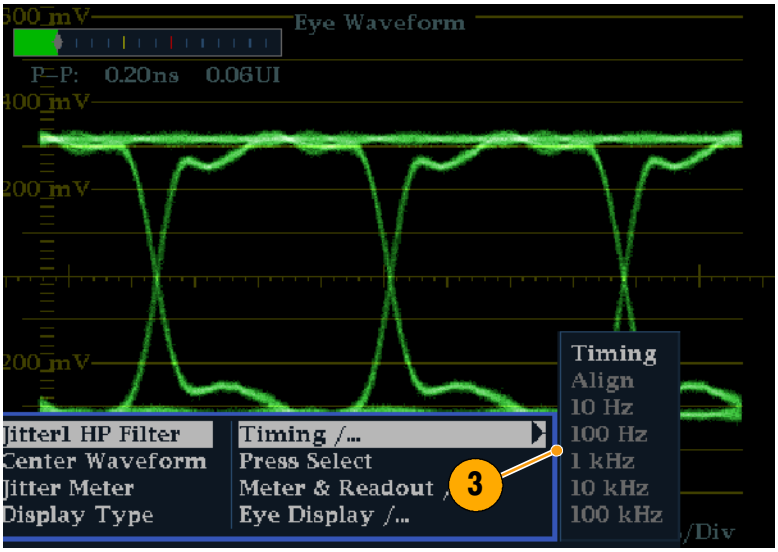
## To Manually Measure Jitter Using the Eye Display

***NOTE.*** *If you use the measurement cursors to measure jitter, you may measure a different result than that shown in the jitter thermometer for the following reasons:*

- *The internal peak detector does a better job of measuring jitter excursions than manually positioning the cursors.*
- *The noise floor is removed from the jitter measurement readout but not from the cursor delta readout.*

1. Perform the initial setup for Eye measurements. (See page 58.)
2. Use the **LINE SWEEP** button to select the 3 EYE mode, which shows peak jitter at each eye crossing.
3. Use the Eye pop-up menu to set the jitter high-pass filter to one of the following:
   - To measure timing jitter, select the 10 Hz filter for both SD and HD signals, or select the Timing filter.
   - To measure alignment jitter, select the 1 kHz filter for SD signals or select the 100 kHz filter for HD signals, or select the Align filter.



4. Press the **CURSOR** button to display the measurement cursors.

5. Position the first timing cursor at the left edge of the zero-crossing point of the Eye waveform.

   **NOTE.** *If necessary, use the Gain and Sweep controls for better vertical and horizontal resolution.*

6. Position the second timing cursor at the right edge of the zero-crossing point of the Eye waveform.

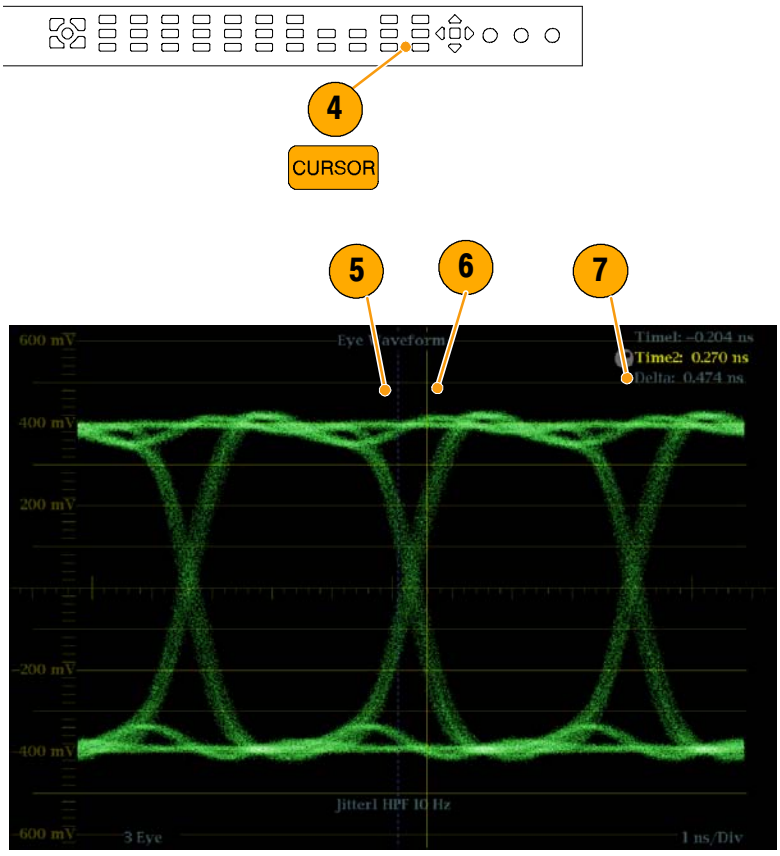
7. Check that the Delta readout is less than the following:

   SD Signals (per SMPTE 259M)

   - Timing jitter (10 Hz filter): 740 ps (0.2 unit intervals ).
   - Alignment jitter (1 kHz filter): 740 ps (0.2 unit intervals ).

   HD Signals (per SMPTE 292M)

   - Timing jitter (10 Hz filter): 673 ps (1.0 unit intervals ).
   - Alignment jitter (100 kHz filter): 134 ps (0.2 unit intervals ).

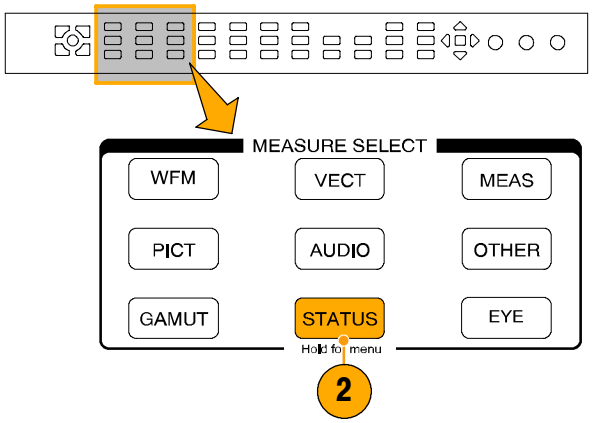


# To Take Cable Loss Measurements

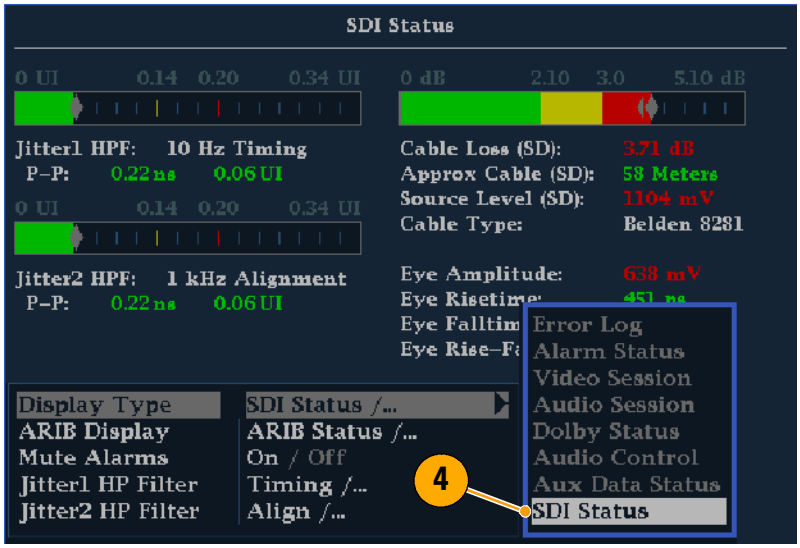
After you have configured the instrument for Eye measurements, you can take cable-loss measurements using the SDI Status display.

***NOTE**. The Approx Cable (length) and Source Level readouts of the SDI Status display are derived from the measured Cable Loss and the specified Cable Type. The Source Level readout indicates the calculated signal amplitude at the signal source, even when the signal level is greatly reduced at the waveform rasterizer due to cable loss. Therefore, the automatic Eye Amplitude measurement (Option PHY only) may be significantly less than the indicated Source Level. The accuracy of the Approx Cable (length) and Source Level readouts depend strongly on correctly setting the Cable Type, and on the quality of the cable and connections in the signal path.*

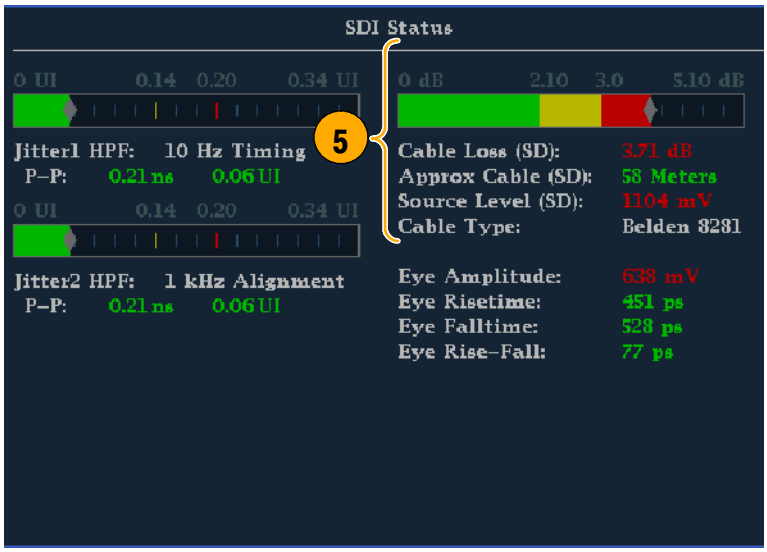
1. Perform the initial setup for Eye measurements. (See page 58.)
2. Press the **STATUS** button to select the Status display.
3. Press and hold the **STATUS** button to display the pop-up menu.




4. Use the arrow keys and the **SEL** button to select the SDI Status display.



5. Use the Cable Loss thermometer and readouts to monitor the cable loss.



# How to Use the ARIB Displays

The waveform rasterizer supports conformance to ARIB data standards contained in the signal source. This information is contained in the following screen displays:

- ARIB Status
- ARIB STD-B.39 Display
- ARIB STD-B.37 Display
- ARIB STD-B.35 Display
- ARIB TR-B.23 (1) Display
- ARIB TR-B.23 (2) Display
- ARIB TR-B.22 Display

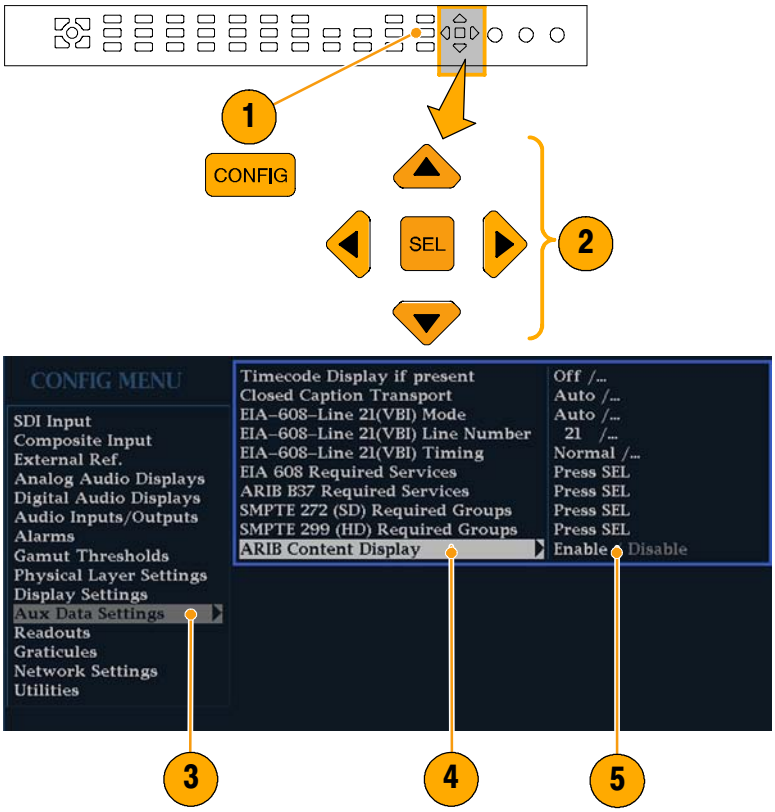
Table 1 lists the DID and SDID values that are defined for common types of ARIB-compliant data.

**Table 1: DID and SDID values for common ARIB data types**

| Ancillary data type | DID value | SDID value |
|---|---|---|
| ARIB TR-B.22, Sub Information of transmitting materials | 0x5F | 0xE0 |
| ARIB TR-B.23, Line 20 User Data - 1 | 0x5F | 0xFC |
| ARIB TR-B.23, Line 20 User Data - 2 | 0x5F | 0xFB |
| ARIB STD-B.35 Trigger Signal for Data Broadcasting | 0x5F | 0xFD |
| ARIB STD-B.37 Closed Captioning | | |
| Analog signal | 0x5F | 0xDD |
| SD signal | 0x5F | 0xDE |
| HD signal | 0x5F | 0xDF |
| ARIB STD-B.39 Inter Stationary Control Data | | |
| ARIB specification | 0x5F | 0xFE |
| ITU specification | 0x43 | 0x01 |

## To enable the ARIB Content Displays

1. Press the CONFIG button to display the CONFIG menu.
2. Use the Arrow keys and **Sel** Button to set the menu in the steps that follow.
3. Select **Aux Data Settings**.
4. Select **ARIB Content Display.**
5. Select **Enable** to access the ARIB displays and alarms; or **Disable** to block access.



# ARIB Status

The ARIB Status display is a status summary screen for the signal. (See Figure 2.)

**Figure 2: ARIB Status display, showing no data present**

Use the ARIB Status display in conjunction with the other specific ARIB Display screens to quickly determine if the data you are interested in is present in the signal. If the data is present, use the STATUS > ARIB Display menu to select the specific ARIB data packet type to view.

The ARIB Status display shows the presence (or absence) of each of the following supported standards (STD) or technical reports (TR):

- Transmitting station code (unique identification code of the transmitting station)
- Transmitting station time (time of broadcast from the transmitting station)
- ARIB STD-B.39 (inter-stationary control data)
- ARIB STD-B.37 (closed caption data)
- ARIB STD-B.35 (trigger signal data)
- ARIB TR-B.23 (1) (guidelines for inter-stationary control data transport, group 1)
- ARIB TR-B.23 (2) (guidelines for inter-stationary control data transport, group 2)
- ARIB TR-B.22 (guidelines for ancillary data transport)

Additionally, the status of the following ITU standard is shown:

- ITU.R BT-1685 (inter-stationary Control Data conveyed by ancillary data packets)

# ARIB STD-B.39 Display

The ARIB STD-B.39 display shows the decoded data for video signals using ancillary data compliant with ARIB STD-B.39. (See Figure 3.) When this display is selected, the instrument searches the signal for ARIB STD-B.39 packets using the DID/SDID combinations defined by either the ITU or ARIB standards organizations.

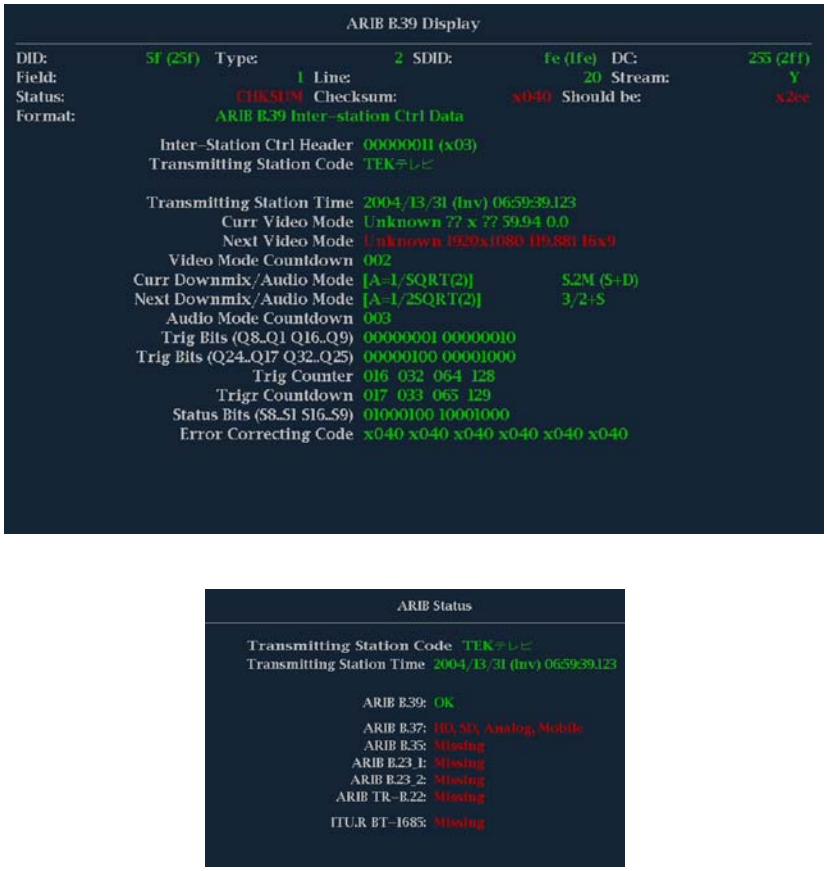

ARIB B.39 Display
DID: 5f (25f) Type: 2 SDID: fe (1fe) DC: 255 (2ff)
Field: 1 Line: 20 Stream: Y
Status: CHKSUM Checksum: x040 Should be: x2ce
Format: ARIB B.39 Inter-station Ctrl Data
Inter-Station Ctrl Header 00000011 (x03)
Transmitting Station Code TEKテレビ
Transmitting Station Time 2004/13/31 (Inv) 0659:39.123
Curr Video Mode Unknown ?? x ?? 59.94 0.0
Next Video Mode Unknown 1920x1080 119.881 16x9
Video Mode Countdown 002
Curr Downmix/Audio Mode [A=1/SQRT(2)] S.2M (5+D)
Next Downmix/Audio Mode [A=1/2SQRT(2)] 3/2+S
Audio Mode Countdown 003
Trig Bits (Q8..Q1 Q16..Q9) 00000001 00000010
Trig Bits (Q24..Q17 Q32..Q25) 00000100 00001000
Trig Counter 016 032 064 128
Trigr Countdown 017 033 065 129
Status Bits (S8..S1 S16..S9) 01000100 10001000
Error Correcting Code x040 x040 x040 x040 x040 x040
ARIB Status
Transmitting Station Code TEKテレビ
Transmitting Station Time 2004/13/31 (Inv) 0659:39.123
ARIB B.39: OK
ARIB B.37: HD, SD, Analog, Mobile
ARIB B.35: Missing
ARIB B.23_1: Missing
ARIB B.23_2: Missing
ARIB TR-B.22: Missing
ITU.R BT-1685: Missing

**Figure 3: ARIB STD-B.39 display (with the associated ARIB Status display)**

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested inter-stationary control packet; can be any of the following:
  - ARIB specification - 0x5F
  - ITU Specification - 0x43
- Type - Type of the ANC Data packet. For ARIB B.39, this is always a Type 2 packet (DID less than 0x80), as defined by SMPTE 291M. The actual value (with parity bits added) is displayed in parentheses.
- SDID - Secondary Data Identifier of the requested interstationary control packet; can be any of the following:
  - ARIB specification - 0xFE
  - ITU Specification - 0x01

- Line - The line of the video (within the field) from which the packet was acquired.
- Stream - For HD (SMPTE 292M), indicates whether the ancillary packet was acquired from the Y or C data streams. For SD, N/A is displayed.
- Status - Indicates whether packet(s) of the desired type are present in the video; also indicates Checksum or CRC errors.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Should be - Indicates the checksum word computed by the instrument, based on the packet's data.
- Format - Indicates the name of the ancillary data type or standard.
- Inter-Station Ctrl Header - A header byte indicating packet continuity, and the presence or absence of the error correcting code.
- Transmitting Station Code - The name of the transmitting station. The instrument supports the display of Japanese characters.
- Transmitting Station Time - The broadcast time at the transmitting station.
- Current Video Mode - The video format of the current program.
- Next Video Mode - The video format of the next scheduled programming.
- Video Mode Countdown - A countdown timer indicating an upcoming change in video mode, which counts down from 254 (0xFE). A value of 0xFF indicates that no format change is pending within the next several seconds.
- Current Downmix/Audio Mode - Indicates the audio downmix and soundstage configuration of the current program.
- Next Downmix/Audio Mode - Indicates the audio downmix and soundstage configuration of the next scheduled program.
- Audio Mode Countdown - A countdown timer indicating an upcoming change in audio mode, which counts down from 254 (0xFE). A value of 0xFF indicates that no format change is pending within the next several seconds.
- Trigger Bits (Q8..Q1 Q16..Q9) - Together with trigger bits Q24..Q17 Q32..Q25, 32 bits that can be used to indicate changes in the program; usage is user-defined.
- Trigger Bits (Q24..Q17 Q32..Q25) - Together with trigger bits Q8..Q1 Q16..Q9; 32 bits that can be used to indicate changes in the program; usage is user-defined.
- Trigger Counter - Increments when bits Q1-Q4 go from 0 to 1. Wraps from 254 (0xFE) to zero. Value of 0xFF indicates the trigger counter is not used.
- Trigger Countdown - A countdown timer indicating an upcoming change in trigger bits Q1-Q4, which counts down from 254 (0xFE). A value of 0xFF indicates that no format change is pending within the next several seconds.
- Status Bits (S8..S1 S16..S9) - 16 user-defined status bits.
- Error Correcting Code - A six-word, Reed-Solomon error correcting code, which is used to verify the integrity of the ARIB B.39 or ITU-R BT.1685 packet.

# ARIB STD-B.37 Display and Status Screens

The ARIB STD-B.37 display (see Figure 4) shows the decoded data for video signals using ancillary data compliant with ARIB STD-B.37. When this display is selected, the instrument searches the signal for ARIB STD-B.37 packets using the DID/SDID combinations defined by ARIB.

**Figure 4: ARIB STD-B.37 display (with the associated ARIB Status display)**

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested closed captioning packet; can be any of the following:
  - Analog signal - 0x5F
  - SD Signal - 0x5
  - HD Signal - 0x5F

- SDID - Secondary Data Identifier of the requested packet; can be any of the following:
  - Analog signal - 0xDD
  - SD Signal - 0xDE
  - HD Signal - 0xDF
  - Mobile signal - 0xDC
- Field/Line - The field or line of the video from which the packet was acquired. For progressive formats, 1 is displayed.

***NOTE**. The Line field turns red if the ARIB B.37 packets are not on the line as defined by ARIB TR-B.23.*

- Format - Indicates the name of the ancillary data type or standard.
- Header 1st - Displays the first of four User Data Words of the corresponding packet, in binary.
- Header 2nd - Displays the second of four User Data Words of the corresponding packet, in binary.
- Header 3rd - Displays the third of four User Data Words of the corresponding packet, in binary.
- Header 4th - Displays the last of four User Data Words of the corresponding packet, in binary.
- ECC Status - Indicates the presence or absence of the Error Correcting Code information in the payload.
- Format ID - Indicate whether the packet is for HD, SD, Analog, or Mobile captions.
- Language - Indicates the language code (1st through 8th) of the packet.
- CC Data ID - Indicates the CC Data ID of the packet. Can be one of the following:
  - Exchange Format CC
  - Exchange Format PMI
  - Exchange Format Page 1
  - Exchange Format Page 2
  - Short Form Management Data
  - Short Form Text
  - Undefined or Dummy Data
- Set Mode - Mode can be either Sequential or Buffer.
- Packet Flags - Indicates whether the packet is Leading, End, Intermediate, or Single.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Placement - Can display either OK or ERROR, indicating whether the ARIB B.37 packets are present in the allowable configuration(s) specified in ARIB TR-B.23.



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# ARIB STD-B.35 Display and Status Screens

The ARIB STD-B.35 display (see Figure 5) shows the decoded data for video signals using ancillary data compliant with ARIB STD-B.35. When this display is selected, the instrument searches the signal for ARIB STD-B.35 packets using the DID/SDID combinations defined by ARIB.

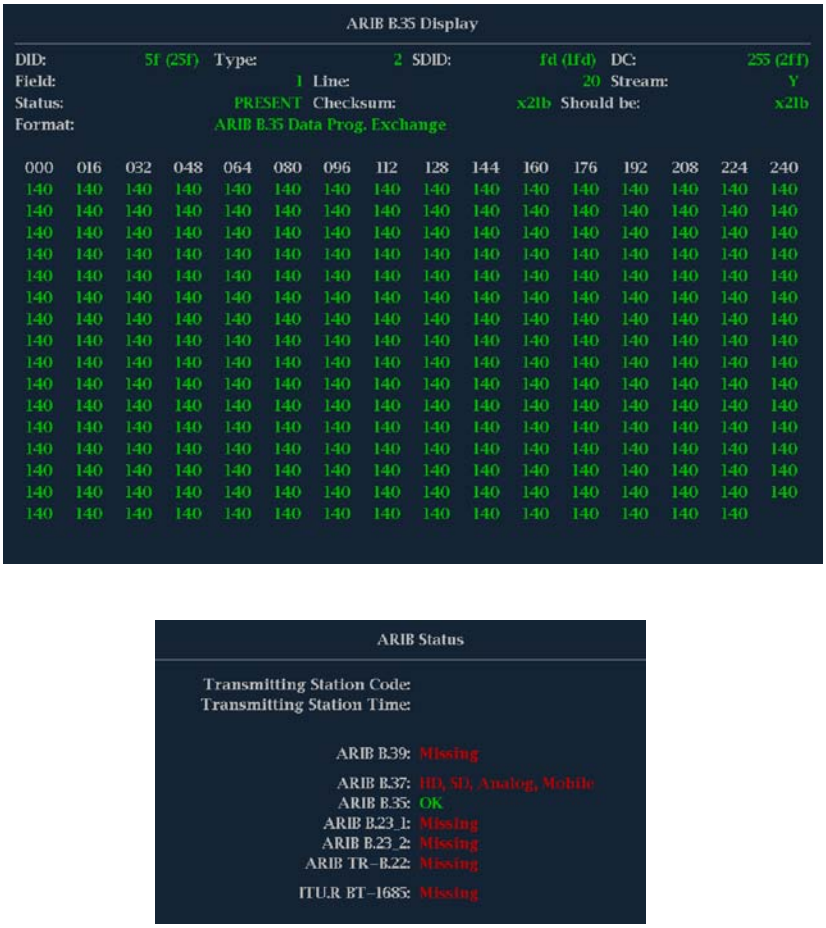

ARIB B.35 Display
DID: 5f (25f) Type: 2 SDID: fd (1fd) DC: 255 (2ff)
Field: 1 Line: 20 Stream: Y
Status: PRESENT Checksum: x21b Should be: x21b
Format: ARIB B.35 Data Prog. Exchange
000 016 032 048 064 080 096 112 128 144 160 176 192 208 224 240
ARIB Status
Transmitting Station Code:
Transmitting Station Time:
ARIB B.39: Missing
ARIB B.37: HD, SD, Analog, Mobile
ARIB B.35: OK
ARIB B.23_1: Missing
ARIB B.23_2: Missing
ARIB TR-B.22: Missing
ITU.R BT-1685: Missing

**Figure 5: ARIB STD-B.35 display (with the associated ARIB Status display)**

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested packet; permissible values range from 1 to 0xFF (255) inclusive.
- Type - Type of the ANC Data packet. For ARIB B.35, this is always a Type 2 packet (DID less than 0x80), as defined by SMPTE 291M. The actual value (with parity bits added) is displayed in parentheses.
- SDID - Secondary Data Identifier of the requested packet; permissible values range from 0 through 0xFF (255) inclusive. This field only appears when a Type 2 packet is selected (see above). The actual value (with parity bits added) is displayed in parentheses.
- DC - Data Count word of the acquired packet. The number of User Data words is displayed in decimal. The actual value (with parity bits added) is displayed in parenthesis, in hexadecimal.

- Field - The field of the video from which the packet was acquired. For progressive formats, 1 is displayed.
- Line - The line of the video (within the field) from which the packet was acquired.
- Stream - For HD (SMPTE 292M), indicates whether the ancillary packet was acquired from the Y or C data streams. For SD, N/A is displayed.
- Status - Indicates whether packet(s) of the desired type are present in the video; also indicates Checksum or CRC errors.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Should be - Indicates the checksum word computed by the instrument, based on the packet's data.
- Format - Indicates the name of the ancillary data type or standard.
- *User Data Words* - Contains the payload of the ancillary packet, displayed in hexadecimal. All 10 bits are displayed.

## ARIB TR-B.23 (1) Display and Status Screens

The ARIB TR-B.23 (1) display (see Figure 6) shows the decoded data for video signals using ancillary data compliant with ARIB TR-B.23 (1). When this display is selected, the instrument searches the signal for ARIB TR-B.23 (1) packets using the DID/SDID combinations defined by ARIB.

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested packet; permissible values range from 1 to 0xFF (255) inclusive.
- Type - Type of the ANC Data packet. For ARIB TR-B.23-1, this is always a Type 2 packet (DID less than 0x80), as defined by SMPTE 291M. The actual value (with parity bits added) is displayed in parentheses.
- SDID - Secondary Data Identifier of the requested packet; permissible values range from 0 through 0xFF (255) inclusive. This field only appears when a Type 2 packet is selected (see above). The actual value (with parity bits added) is displayed in parentheses.
- DC - Data Count word of the acquired packet. The number of User Data words is displayed in decimal. The actual value (with parity bits added) is displayed in parenthesis, in hexadecimal.
- Field - The field of the video from which the packet was acquired. For progressive formats, 1 is displayed.
- Line - The line of the video (within the field) from which the packet was acquired.
- Stream - For HD (SMPTE 292M), indicates whether the ancillary packet was acquired from the Y or C data streams. For SD, N/A is displayed.
- Status - Indicates whether packet(s) of the desired type are present in the video; also indicates Checksum or CRC errors.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Should be - Indicates the checksum work computed by the instrument, based on the packet's data.
- Format - Indicates the name of the ancillary data type or standard.
- *User Data Words* - Contains the payload of the ancillary packet, displayed in hexadecimal. All 10 bits are displayed.

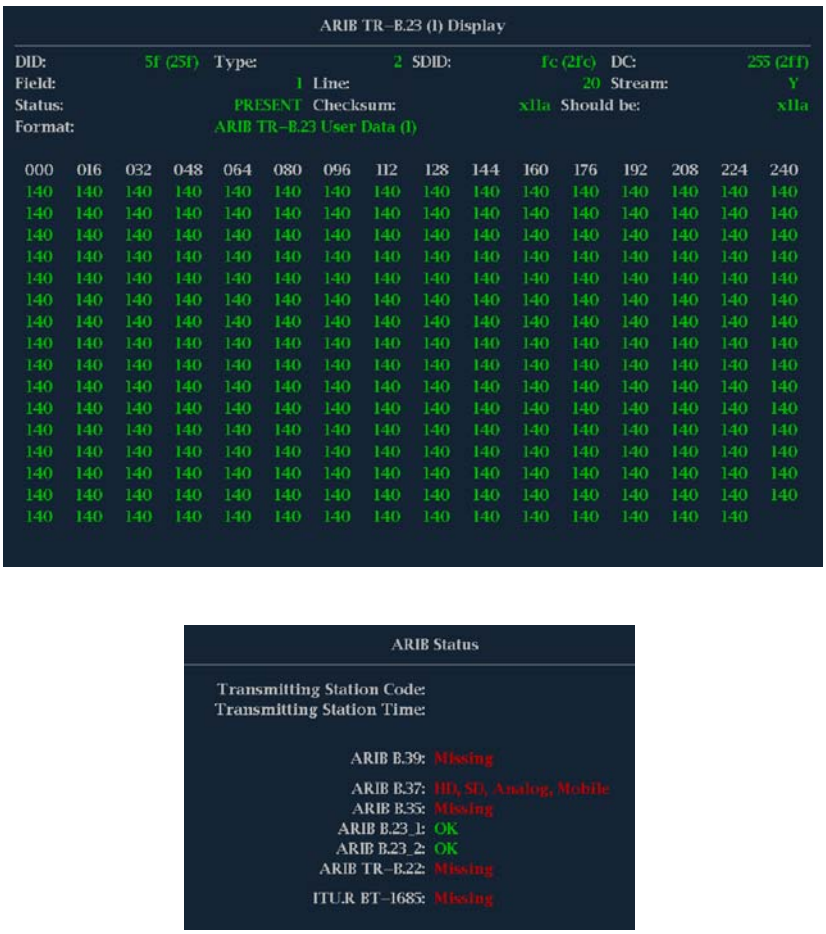

ARIB TR–B.23 (1) Display
DID: 5f (25f) Type: 2 SDID: fc (2fc) DC: 255 (2ff)
Field: 1 Line: 20 Stream: Y
Status: PRESENT Checksum: x11a Should be: x11a
Format: ARIB TR–B.23 User Data (1)
000 016 032 048 064 080 096 112 128 144 160 176 192 208 224 240
ARIB Status
Transmitting Station Code:
Transmitting Station Time:
ARIB B.39: Missing
ARIB B.37: HD, SD, Analog, Mobile
ARIB B.35: Missing
ARIB B.23_1: OK
ARIB B.23_2: OK
ARIB TR–B.22: Missing
ITU.R BT–1685: Missing

**Figure 6: ARIB TR-B.23 (1) display (with the associated ARIB Status display)**

# ARIB TR-B.23 (2) Display and Status Screens

The ARIB TR-B.23 (2) display (see Figure 7) shows the decoded data for video signals using ancillary data compliant with ARIB TR-B.23 (2). When this display is selected, the instrument searches the signal for ARIB TR-B.23 (2) packets using the DID/SDID combinations defined by ARIB.

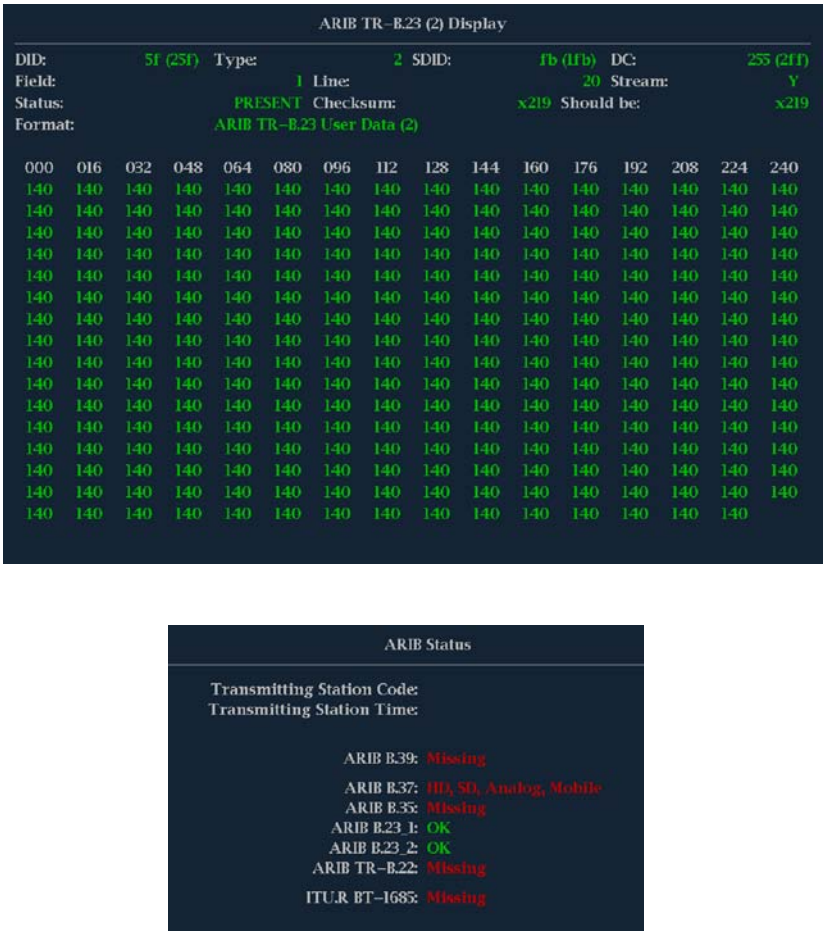

ARIB TR-B.23 (2) Display
DID: 5f (25f) Type: 2 SDID: fb (1fb) DC: 255 (2ff)
Field: 1 Line: 20 Stream: Y
Status: PRESENT Checksum: x219 Should be: x219
Format: ARIB TR-B.23 User Data (2)
000 016 032 048 064 080 096 112 128 144 160 176 192 208 224 240
ARIB Status
Transmitting Station Code:
Transmitting Station Time:
ARIB B.39: Missing
ARIB B.37: HD, SD, Analog, Mobile
ARIB B.35: Missing
ARIB B.23_1: OK
ARIB B.23_2: OK
ARIB TR-B.22: Missing
ITU.R BT-1685: Missing

**Figure 7: ARIB TR-B.23 (2) display (with the associated ARIB Status display)**

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested packet; permissible values range from 1 to 0xFF (255) inclusive.
- Type - Type of the ANC Data packet. For ARIB TR-B.23-2, this is always a Type 2 packet (DID less than 0x80), as defined by SMPTE 291M. The actual value (with parity bits added) is displayed in parentheses.
- SDID - Secondary Data Identifier of the requested packet; permissible values range from 0 through 0xFF (255) inclusive. This field only appears when a Type 2 packet is selected (see above). The actual value (with parity bits added) is displayed in parentheses.
- DC - Data Count word of the acquired packet. The number of User Data words is displayed in decimal. The actual value (with parity bits added) is displayed in parenthesis, in hexadecimal.

- Field - The field of the video from which the packet was acquired. For progressive formats, 1 is displayed.
- Line - The line of the video (within the field) from which the packet was acquired.
- Stream - For HD (SMPTE 292M), indicates whether the ancillary packet was acquired from the Y or C data streams. For SD, N/A is displayed.
- Status - Indicates whether packet(s) of the desired type are present in the video; also indicates Checksum or CRC errors.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Should be - Indicates the checksum work computed by the instrument, based on the packet's data.
- Format - Indicates the name of the ancillary data type or standard.
- *User Data Words* - Contains the payload of the ancillary packet, displayed in hexadecimal. All 10 bits are displayed.

## ARIB TR-B.22 Display and Status Screens

The ARIB TR-B.22 display (see Figure 8) shows the decoded data for video signals using ancillary data compliant with ARIB TR-B.22. When this display is selected, the instrument searches the signal for ARIB TR-B.22 packets using the DID/SDID combinations defined by ARIB.

The decoded ancillary data includes the following:

- DID - Data Identifier of the requested packet; permissible values range from 1 to 0xFF (255) inclusive.
- Type - Type of the ANC Data packet. For ARIB TR-B.22, this is always a Type 2 packet (DID less than 0x80), as defined by SMPTE 291M. The actual value (with parity bits added) is displayed in parentheses.
- SDID - Secondary Data Identifier of the requested packet; permissible values range from 0 through 0xFF (255) inclusive. This field only appears when a Type 2 packet is selected (see above). The actual value (with parity bits added) is displayed in parentheses.
- DC - Data Count word of the acquired packet. The number of User Data words is displayed in decimal. The actual value (with parity bits added) is displayed in parenthesis, in hexadecimal.
- Field - The field of the video from which the packet was acquired. For progressive formats, 1 is displayed.
- Line - The line of the video (within the field) from which the packet was acquired.
- Stream - For HD (SMPTE 292M), indicates whether the ancillary packet was acquired from the Y or C data streams. For SD, N/A is displayed.
- Status - Indicates whether packet(s) of the desired type are present in the video; also indicates Checksum or CRC errors.
- Checksum - Indicates the checksum word that was recovered from the acquired packet.
- Should be - Indicates the checksum work computed by the instrument, based on the packet's data.
- Format - Indicates the name of the ancillary data type or standard.
- *User Data Words* - Contains the payload of the ancillary packet, displayed in hexadecimal. All 10 bits are displayed.

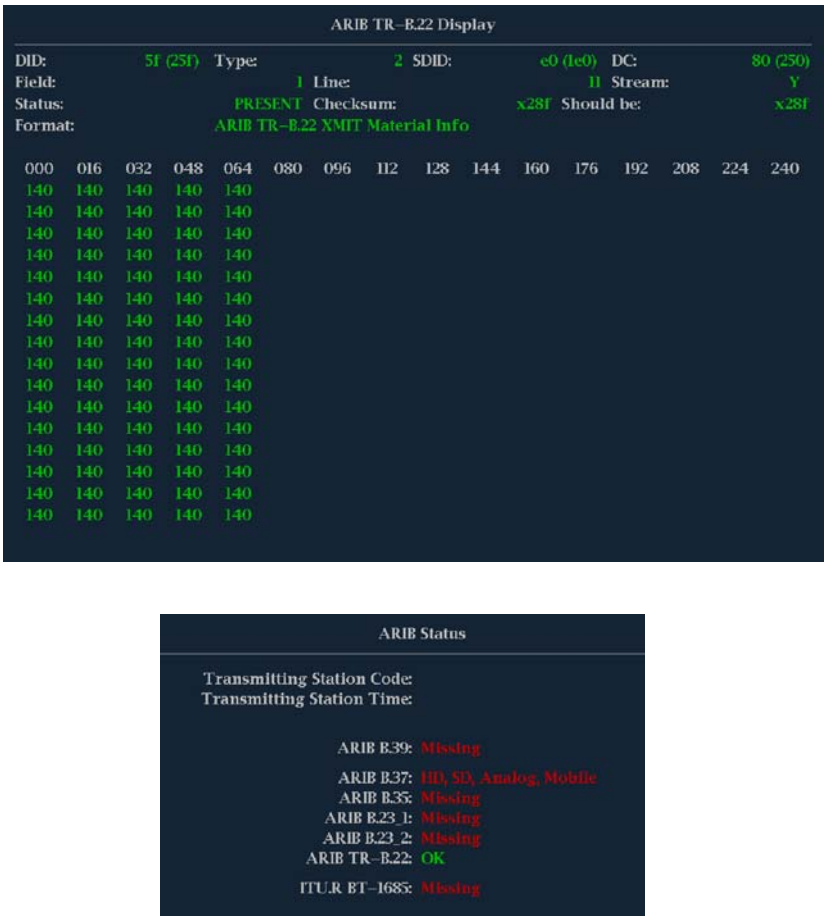

ARIB TR–B.22 Display
DID: 5f (25f) Type: 2 SDID: e0 (1e0) DC: 80 (250)
Field: 1 Line: 11 Stream: Y
Status: PRESENT Checksum: x28f Should be: x28f
Format: ARIB TR–B.22 XMIT Material Info
000 016 032 048 064 080 096 112 128 144 160 176 192 208 224 240
140 140 140 140 140
ARIB Status
Transmitting Station Code:
Transmitting Station Time:
ARIB B.39: Missing
ARIB B.37: HD, SD, Analog, Mobile
ARIB B.35: Missing
ARIB B.23_1: Missing
ARIB B.23_2: Missing
ARIB TR–B.22: OK
ITU.R BT–1685: Missing

**Figure 8: ARIB TR- B.22 display (with the associated ARIB Status display)**

# How to Monitor Audio

The waveform rasterizer provides several methods to monitor audio signals. You can measure levels, monitor phase, display phase correlation, and monitor surround-sound audio. You can specify meter ballistics and scales, set the Test and Peak Program indicator levels, and specify how phase is displayed.

***NOTE**. The audio monitoring features described in this chapter require that appropriate audio options be installed. For example, Option DS adds support for only Digital audio monitoring in embedded and AES/EBU inputs, while a Option AD equipped instrument can monitor both Analog and Digital audio in these inputs.*

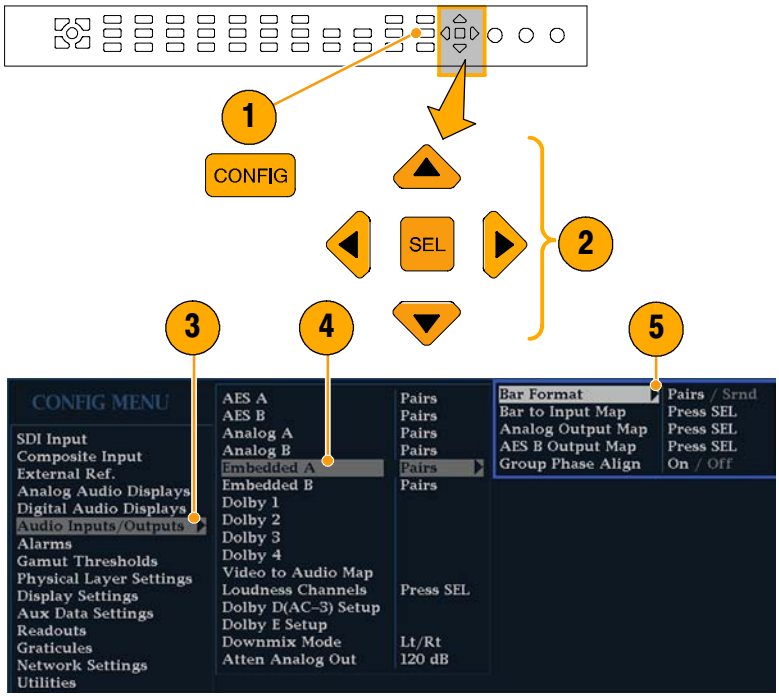
- *For a list of the audio options available and the audio monitoring capabilities they provide, see* Options *on page* 2. *Note that the options listed with a prefix WVR6UP- (for the WVR6100 options) or WVR7UP- (for the WVR7100 options) support upgrades to previously purchased instruments.*
- *For a list of the options that are installed on your product, press the* CONFIG *button. In the* CONFIG *menu, select the* Utilities *submenu. The* View Instruments Options *entry lists the installed options for your instrument.*

## To Configure Audio Inputs

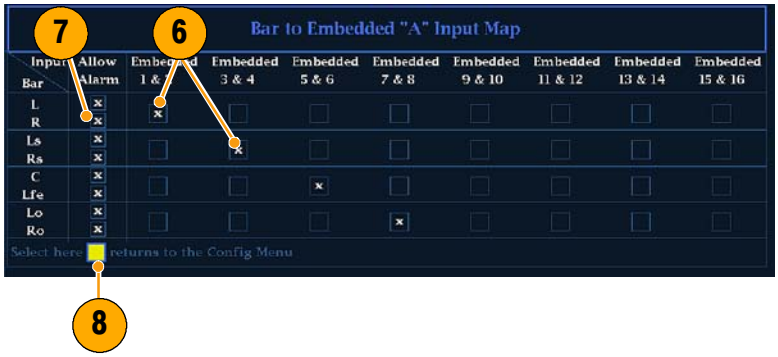
The rasterizer audio inputs may need to be configured in the CONFIG menu before you use them (they come set to FACTORY defaults, which you can restore using the FACTORY front-panel button). Do this procedure (or at least check that the configuration is as you want it) before doing the procedures starting on page 84. Your setup here determines, in part, which audio-signal characteristics are displayed.

### To set up an Audio Input

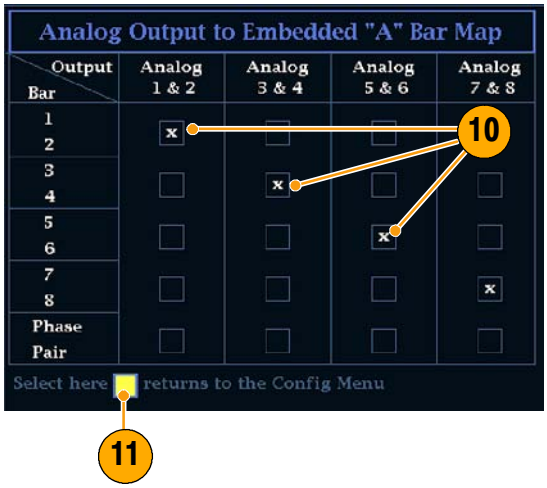
1. Press the CONFIG button to display the CONFIG menu.
2. Use the Arrow keys and **Sel** Button to set the menu in the steps that follow.
3. Select **Audio Inputs/Outputs**.
4. Select the input to be configured.
5. Select from **Srnd (Surround)** for a 5.1- or 5.1 + 2-type display or **Pairs** for a stereo-with-SAP-and-discrete-channels-type installation.



6. Select **Bar to Input Map**, and specify which input pair should be displayed in each bar pair.
7. Specify which inputs will be allowed to generate alarms.
8. Select the box to return to the CONFIG menu.



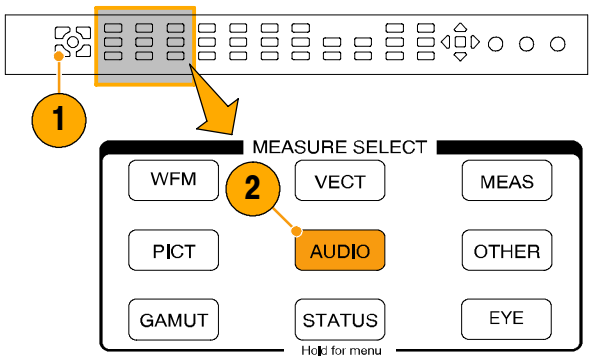

9. Select the **Analog Output Map** in the CONFIG menu.
10. Specify which inputs (if any) are routed to the analog outputs.
11. Select the box to return to the CONFIG menu.
12. Repeat steps 4 through 11 for other audio inputs as needed.



# To Select the Audio Input

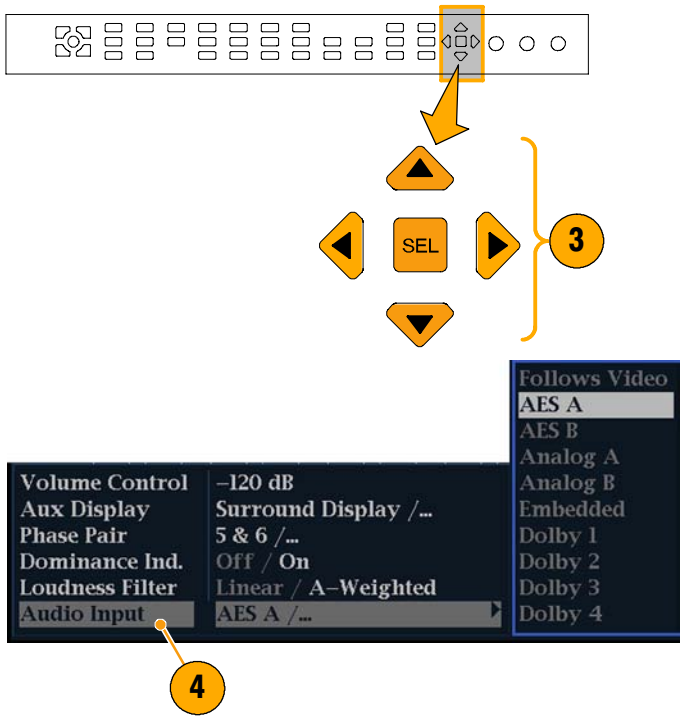
You select the audio input to be monitored from the front-panel AUDIO button pop-up menu. Note that the Audio display can appear in only one tile at a time.

1. Select a tile.
2. Press and hold the Audio button to open the Audio display in a tile and pop up the Audio menu.




3. Use the Arrow Keys and **SEL** Button to set the menu in the steps that follow.
4. Select **Audio Input**, and then select one of the audio input options shown.

   ***NOTE.*** *The available selections depend on the installed audio option. Selecting Follows Video selects the audio to video mapping set in the Configuration menu. (See page 82.)*



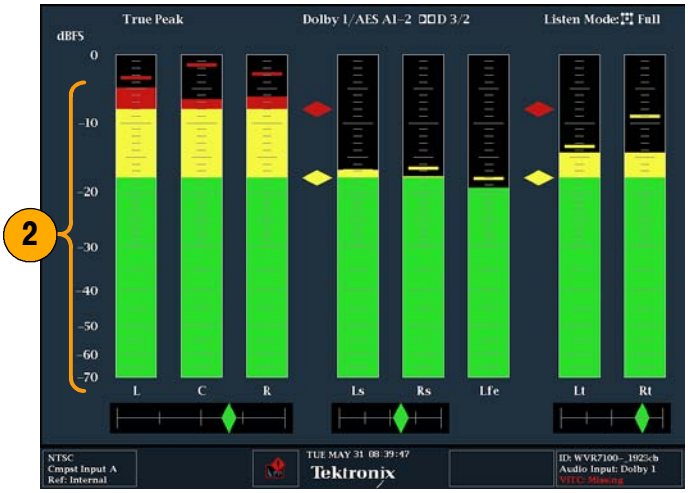
# To Check Audio Level & Phase

The waveform rasterizer level meters are vertical bar graphs where the height of the bar indicates the amplitude of the audio program in the corresponding input channel. You can change the input and turn on and off the Phase display from the audio pop-up menu. Other meter characteristics such as ballistics, scale units, and program/test levels are configured through the Configuration menu.

The waveform rasterizer, with optional audio, can display phase of one input pair as a Lissajous pattern, and it can display relative phase on all four pairs of inputs with correlation meters.

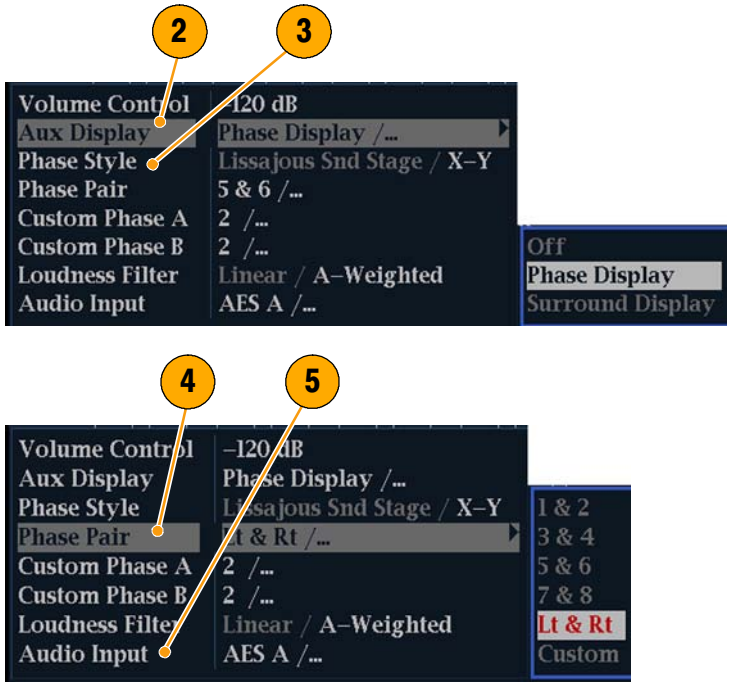
## To Check Level

1. Open the audio monitor in a tile and select an input. (See page 84.)
2. Check the level meter bars for current audio levels, which are displayed according to the selected meter ballistics. Each bar displays three colors:
   - Green—Indicates audio levels below the test level.
   - Yellow—Indicates audio levels between the test and peak program level.
   - Red—Indicates audio levels above the peak program level.



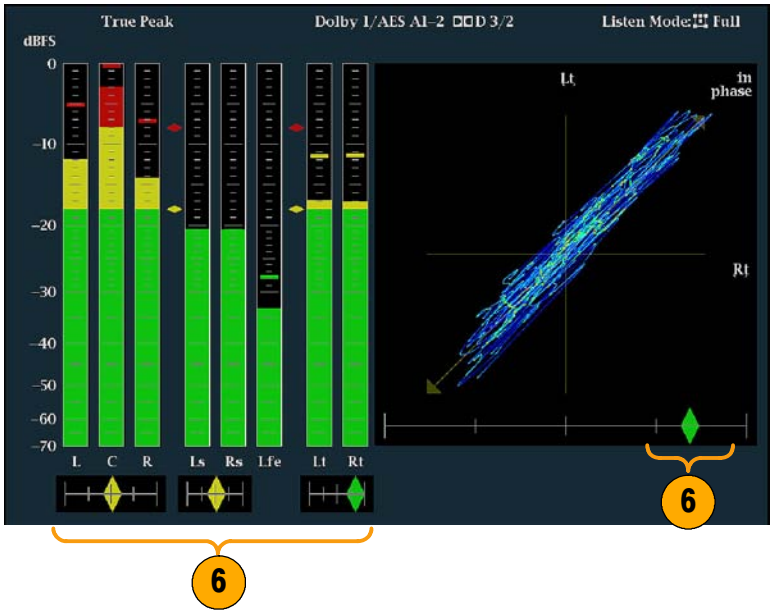

## To Check Phase

1. Open the audio monitor in a tile. (See page 84.) Use the Selection Keys and Button to set the menu in the steps that follow.
2. Select **Aux Display**, and then select **Phase Display** to turn it on.
3. Select the **Phase Style**. Choose either a **Lissajous Soundstage** or **X-Y** orientation for the Lissajous signal. (See *Usage Notes* on page 86.)
4. Select the Phase Pair to be displayed. Or select **Custom**, and select independent channels using the Phase Channel A and Phase Channel B entries.
5. Set the Audio Input to match the signal that you are checking.



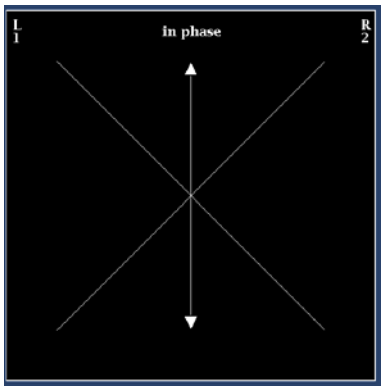
6. Check for Phase correlation of the signals, noting the following:

   - Phase correlation meters are located under the appropriate bars and one is duplicated under the phase display.
   - For correlated signals, the indicator will be green, and will move to the right side.
   - For uncorrelated signals, the indicator will be yellow, and will tend to stay in the middle.
   - For anticorrelated signals (one goes up when the other goes down), the indicator will be red, and will move to the left side.

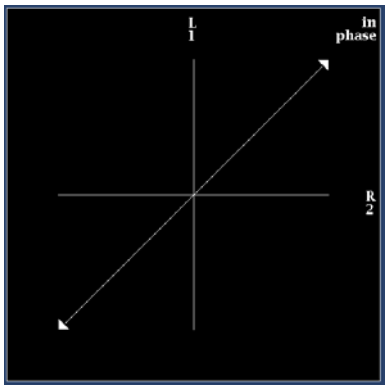



## Usage Notes

- The Lissajous or phase display is a plot of one channel against another on an orthogonal pair of axes.
- Soundstage plots the two channels at 45 degree angles, with the mono combination appearing on the vertical axis—like a left-right image in a studio.
- X-Y plots left-channel data on the vertical axis and right channel data on the horizontal axis, emulating the X-Y display of an oscilloscope.



Lissajous sound stage



X-Y orientation

- The response time of the correlation meters can be set from the CONFIG menu. The choices follow.

| Speed setting | Response averaging time (s) | Speed setting | Response averaging time (s) |
|---|---|---|---|
| 1 | 0.0167 | 11 | 3.0 |
| 2 | 0.0333 | 12 | 3.5 |
| 3 | 0.0667 | 13 | 4.0 |
| 4 | 0.1333 | 14 | 4.5 |
| 5 | 0.2667 | 15 | 5.0 |
| 6 | 0.5333 | 16 | 5.5 |
| 7 | 1.0 | 17 | 6.0 |
| 8 (default) | 1.5 | 18 | 6.5 |
| 9 | 2.0 | 19 | 7.0 |
| 10 | 2.5 | 20 | 7.5 |

# To Check Surround Sound

The waveform rasterizer can also display the surround sound listening environment.

## To Check Surround Sound

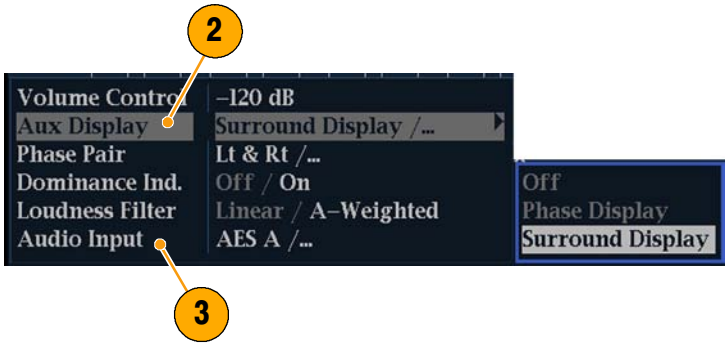
1. Open the audio display in a tile and select the input containing the surround audio. (See page 84.)

2. Select **Aux Display**, and then select **Surround Sound Display**. Press **SEL** or the right-arrow key to turn the phase display on.

3. Set the Audio Input to match the signal that you are checking.

   ***NOTE.*** *If you want the level bars labeled with their surround sound channel names instead of channel numbers, select Srnd (Surround) when you configure the audio inputs. (See page 82.)*

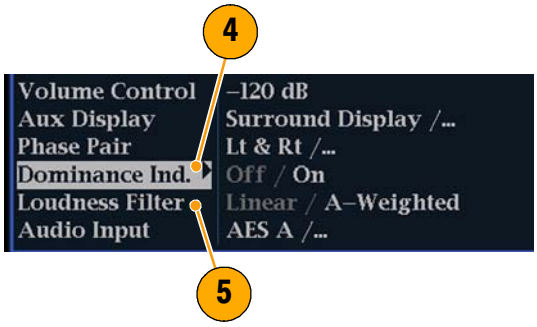
   *You can also set the Dolby Listening mode. (See page 90,* How to Monitor DolbyBased Surround Sound*.)*




4. Set the surround **Dominance indicator** to **ON** or **OFF**.

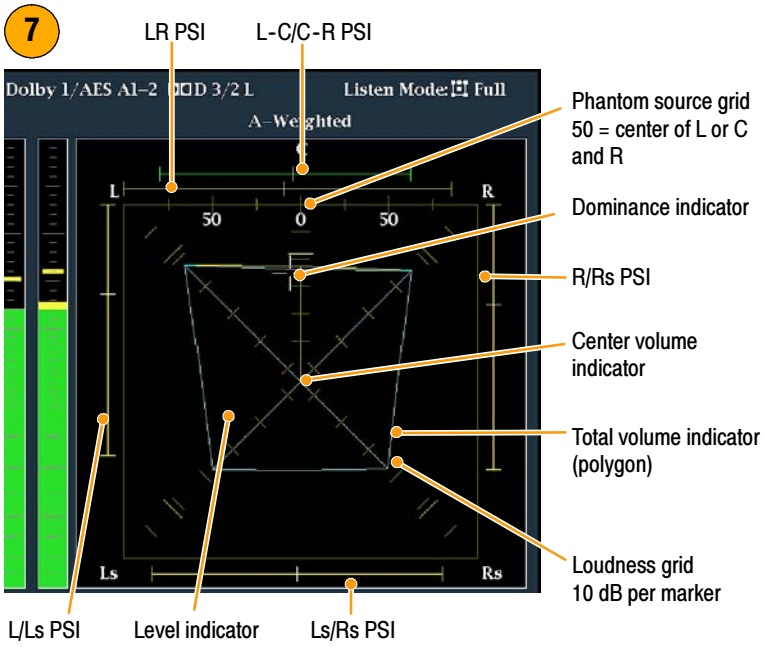
5. Set the **Loudness Filter** to the type preferred. A-Weighting biases the response towards that of human hearing.

6. Use the level bar display to monitor level control. (See page 85, *To Check Level*.)



7. Use the surround display to monitor relative loudness of the individual elements rendered in a surround-sound listening environment. Check the surround sound display for performance parameters and indicators shown right. The indicators are described under usage notes below.

   ***NOTE**: The Audio Surround Sound display is courtesy of Radio-Technische Werkstaetten GmbH & Co. KG (RTW) of Cologne, Germany.*




## Surround Display Elements

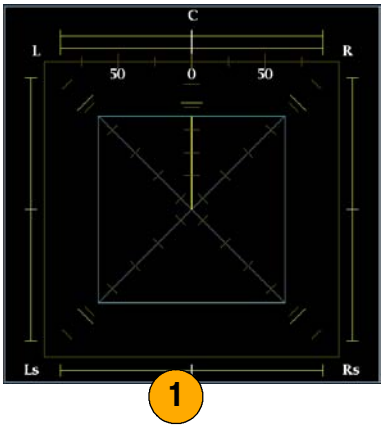
- The Level Indicators—indicates the audio level balance among the left (L), right (R), left-surround (Ls), and right-surround (Rs) channels as cyan lines on the Loudness Grid.
- The Loudness Grid—the ruled scale, radiating from the center, on which the level indicators register their audio level and balance. The scale has tic marks at 10 dB intervals. An additional tic mark indicates the -18 dB level. The -18 dB and -20 dB levels are typically used for aligning audio levels.
- Total Volume Indicator—the cyan polygon formed by connecting the level indicator end points, showing the total sound volume of the L, R, Ls, and Rs channels. Each connecting line will bend away from the center if the two signals have a positive correlation, will bend towards the center if the signals have a negative correlation, and will not bend if the signals are uncorrelated.
- The Center Volume indicator—displays the sound volume of the center channel as a vertical yellow bar between the L and R channels, and connects the ends of the L, C, and R audio level indicators with straight lines.
- Channel-Pair Phantom Sound Indicators (PSIs—located on each side of the Surround Sound display, indicate the location of potential phantom sound sources formed by adjacent channels. The white tic marks on these moving bar indicators show the phantom source locations. The bar length indicates the correlation between the adjacent channels. A short-to-medium length green bar indicates positive correlation between the channels, forming a localized phantom sound source located at the white tic mark. The bar grows to full length and changes color to yellow as the correlation moves to zero, indicating a wide, non-localized sound image. The bar changes color to red for adjacent channels with significant negative correlation. For negative correlations, the ends of the PSI for the L and R channels will continue to grow at a 45 ° angle while the other PSIs remain at full length.

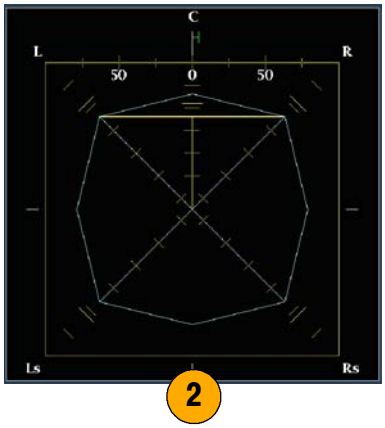
- Center-Pairs Phantom Sound Indicator—a fifth PSI at the top of the display shows potential phantom sources formed by the LC channel pair and the CR channel pair. If the L, R, and C channels all have the same signal level, the white tic mark on the bar will appear directly above the C level indicator. The white tic mark will move right or left depending on the relative balance between the three channels. A short bar to the left of the white tic mark indicates a positive correlation between L and C. The bar will grow as the correlation decreases. Like the L-R PSI, the bar will continue to grow at a 45° angle for negative signal correlations. The bar to the right of the white tic mark behaves in the same way, depending on the C-R correlation. This PSI indicator uses the same color coding as the other PSI indicators.

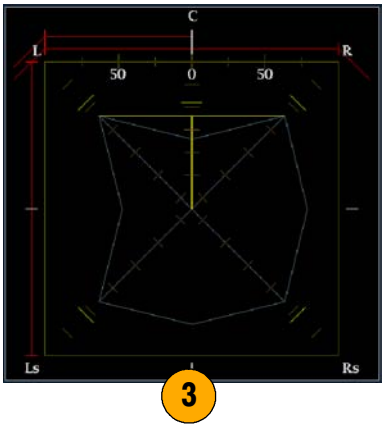
## Usage Notes

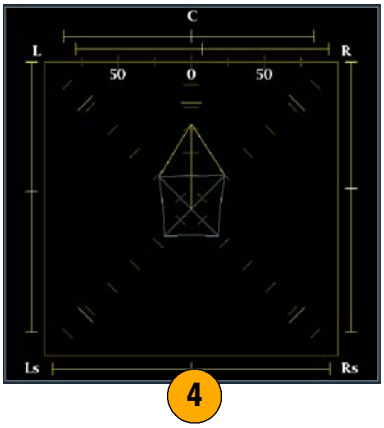
The following displays are examples of how the surround sound waveform appears for some typical signal types.

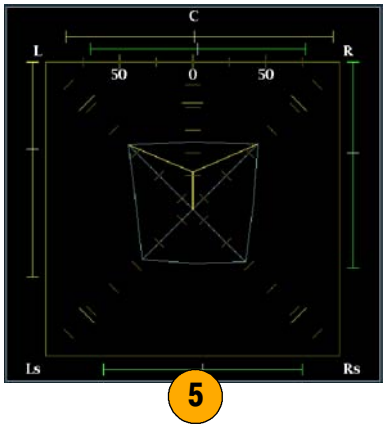
1. Uncorrelated signals; same level in the L, C, R, Ls, and Rs channels.
2. Sine wave test tone; same level in the L, C, R, Ls, and Rs channels. All signals are in phase, creating phantom sources between the adjacent channels.
3. Same as 2, with the exception that Channel L is out of phase.
4. Surround sound program with strong center channel presence.
5. Surround sound program with weak center channel presence.
6. Monaural signal in channels Ls and Rs, creating a phantom source in the center, as in a 3.1 surround sound system.

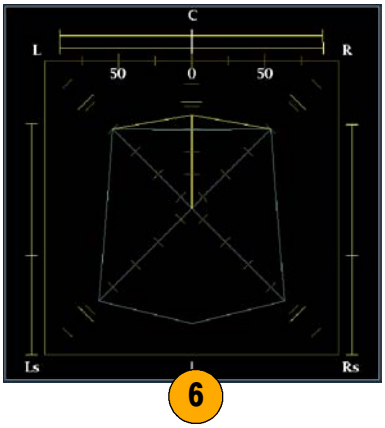


# How to Monitor Dolby-Based Surround Sound

When equipped with the proper options (see *NOTE* below), the waveform rasterizer can decode and monitor audio signals that are based on Dolby digital surround sound formats. These formats are Dolby D (AC-3 ) compression, designed for distribution, and/or Dolby E compression, designed for production. You can specify and configure the Dolby input sources, measure signal levels and monitor phase between Dolby components, and display these relations in the AUDIO display.

***NOTE**. The audio monitoring features described in this chapter require that either* Option DD *or* Option DDE *be installed, depending on the feature.*

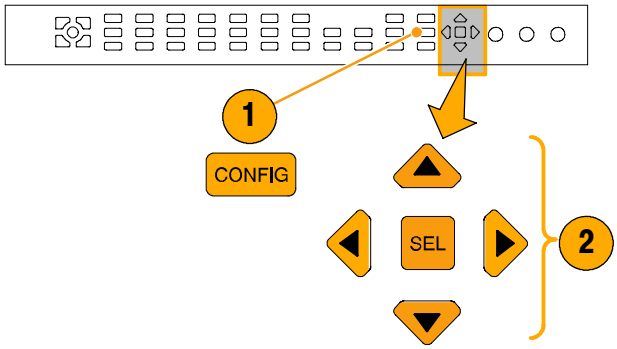
- *A list of the audio options available and the audio monitoring capabilities they provide is located at the front of this manual. (See page 2,* Options.) *Note that the options listed with a prefix WVR6UP- (for the WVR6100 options) or WVR7UP- (for the WVR7100 options) support upgrades for previously purchased instruments.*
- *For a list of the options that are installed on your product, press the CONFIG button, and select* View Instrument Options *in the Utilities menu.*

## To Configure Dolby Inputs

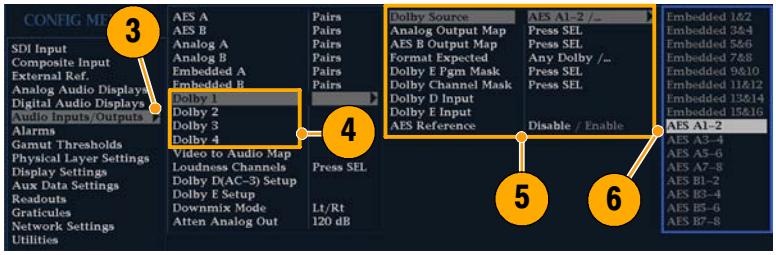
Like other inputs, the Dolby inputs that you select and monitor from the Audio Display may need to be configured before you use them (they come set to FACTORY defaults, which you can restore using the FACTORY front-panel button). Do this procedure (or at least check that the configuration is as you want it) before doing the procedures that follow starting on page 96. Your setup here determines, in part, the Dolby audio-signal characteristics that are displayed.

### To set up Dolby Input Parameters

1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and **SEL** Button to set the menu in the steps that follow.

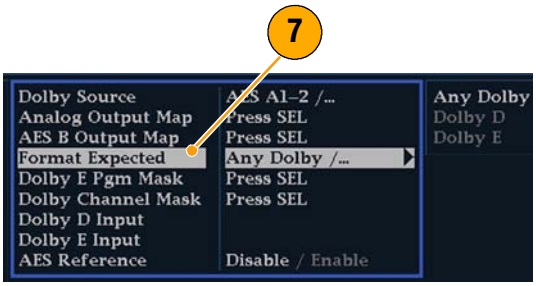



3. Select **Audio Inputs/Outputs.**
4. Select the Dolby Input that you want to configure (one of Dolby 1 - Dolby 4).
5. The Dolby parameters for the selected Dolby Input are now displayed; select each parameter in turn and set up as described in the following steps.
6. Select **Dolby Source**, and choose the embedded or AES input signal pair as the signal source to be decoded for the Dolby input selected in step 4.



7. Select **Format Expected**, and choose the format condition that, when missing, triggers the Dolby Format Alarm.

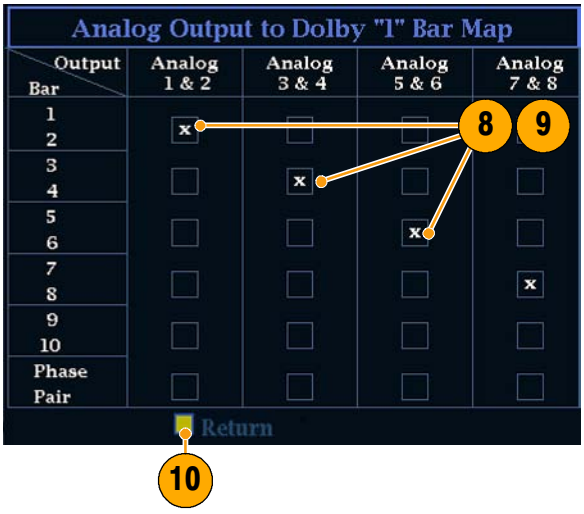
   ***NOTE.*** *The rasterizer auto-selects and decodes the Dolby Format, depending on the Dolby option installed.*




8. **Option DDE only:** Select **Analog Output Map** and specify which inputs (if any) are routed to the analog outputs in the map that appears. (Map shown right.)

9. **Option DDE only:** Select the **AES B Output Map**, and assign specific bar pairs to the AES B outputs in the map that appears. (The AES B bank must be configured as outputs.)
   (Map similar to that shown right.)

   ***NOTE.*** *When a Dolby input is active, channel labels (L, R, Ls, and so on) appear in addition to the channel numbers.*

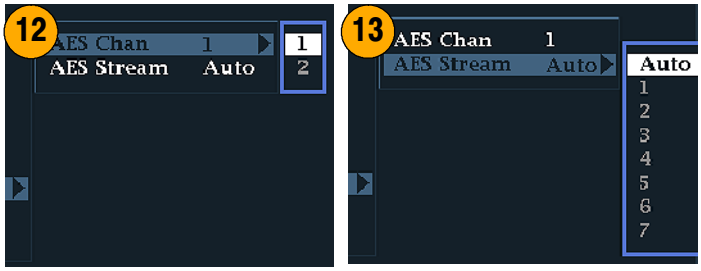



10. Select box to close maps.

11. **Option DD only:** Select and configure the **Output Map** (not shown) to assign a specific bar pair to the Analog and Digital Outputs. (The outputs are limited to a single pair.)

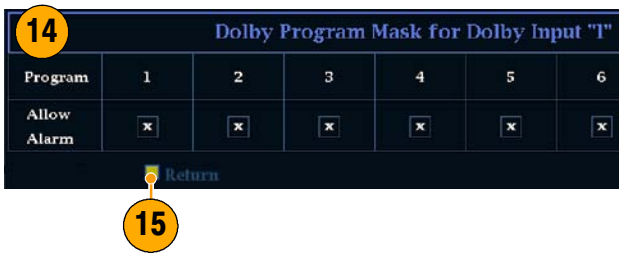
12. **Option DDE only:** Select **Dolby D Input**, and select the AES channel for Dolby content in which the subframes carry two Dolby streams (in Dolby Professional 16-bit mode).

13. **Option DDE only:** Select **Dolby D Input**, and select the stream for Dolby Content in which there can be multiple Dolby Digital streams embedded.




14. **Option DDE only: Select Dolby E Pgm** (Program) **Mask**, and navigate to each box for each program. Press the SEL key to toggle to Allow Alarm (X) or not (blank).

15. Select this box to close the map.

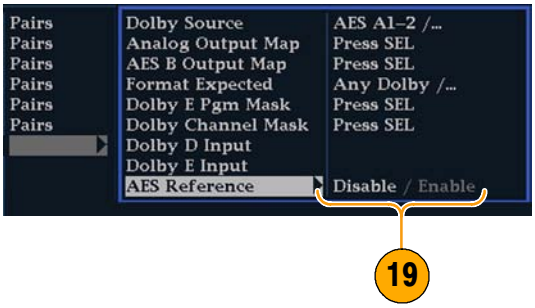


16. **Select Dolby Chan Mask**, and choose which Dolby channels (L, R, C, Lfe, and so on) can trigger alarms based on the decoded content.
17. Select the box to close the map.

18. **Option DDE only:** Select **Dolby E Input**, and select the program from which the downmix is derived.

    ***NOTE.*** *Although 8 programs are listed, the number active depends on the Dolby E Program Configuration detected in the metadata of the Dolby input. (See page 101,* Audio Bar Mapping vs. Dolby E Metadata Program Configuration*.)*

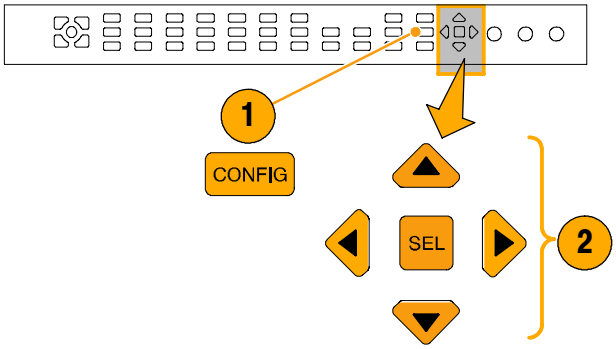
19. Set **AES Ref Enable** to **Disable** or **Enable**. If enabled, and the Dolby Source is set to an AES input, the rasterizer triggers the AES Frame Sync Alarm if the AES input is not locked to the AES reference.
20. Repeat steps 4 through 19 for other Dolby inputs as needed.

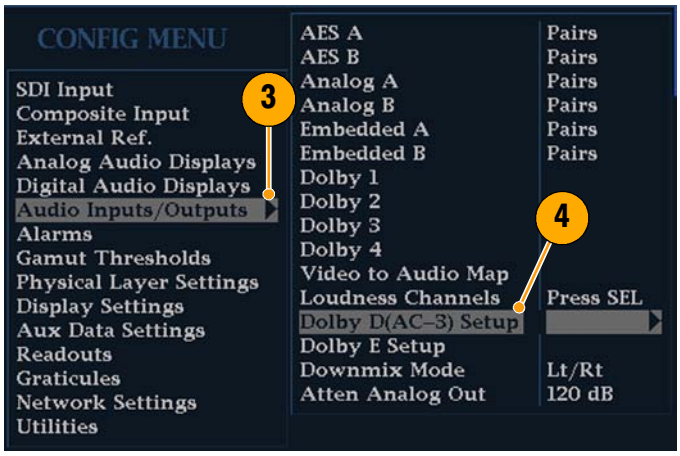


## To set up Dolby Global Parameters:

Do the following steps to set parameters that apply to all four Dolby inputs:

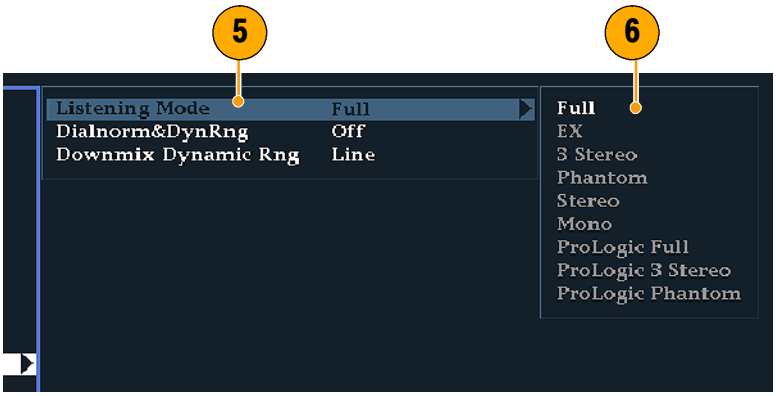
1. Press the CONFIG button to display the Configuration menu.
2. Use the Selection Keys and Sel Button to set the menu in the steps that follow.
3. Select **Audio Inputs/Outputs.**
4. **Option DDE only:** Select **Dolby D (AC-3) Setup**, and make the following settings. The settings will apply to the input when Dolby D is detected for Dolby inputs.



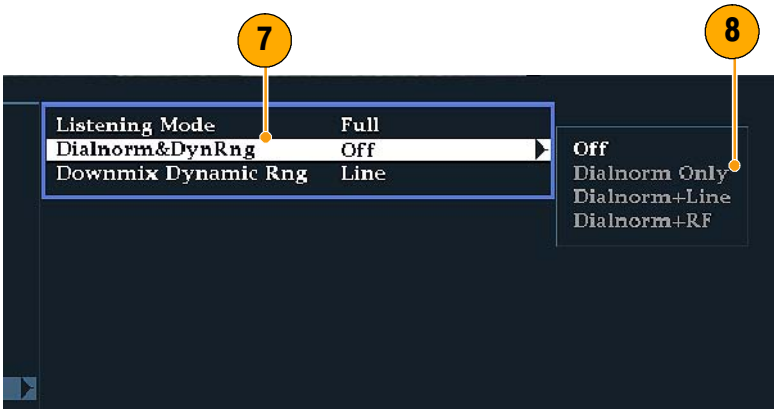




5. **Option DDE only:** Select the Dolby D **Listening Mode**, which controls how the Dolby sound channels map to the level bars and surround-sound elements in the Audio Display and outputs.
6. **Option DDE only:** Choose **Full** or a mode to downmix to. See page 98 for mode descriptions and page 99 for a list of Channel modes vs. Listening modes.

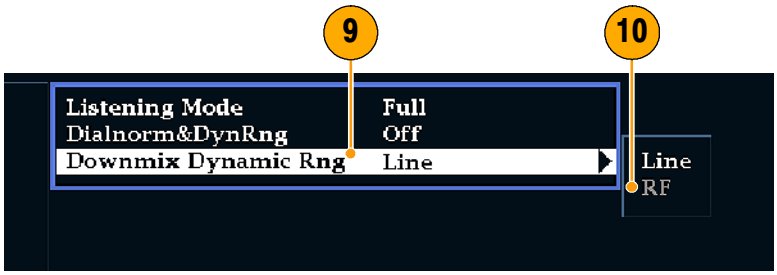
   ***NOTE.*** *Dolby content of the signal at the Dolby input must be sufficient to downmix to the mode selected or the setting has no effect.*



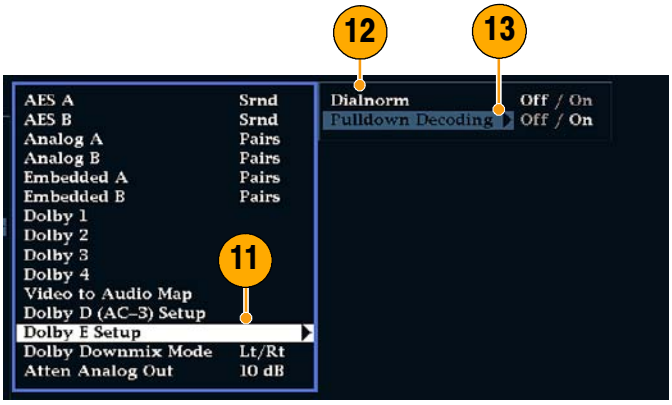
7. **Option DDE only:** Select **Dialnorm&DynRng.**
8. **Option DDE only:** Select **Off** or choose **Dialnorm Only**, **Dialnorm+RF**, or **DialNorm+Line**. RF and Line are modes of Dynamic Range Control (compression) factors that are applied when decoding Dolby content for monitoring or output. (Option DD always is in Dialnorm+Line mode.)

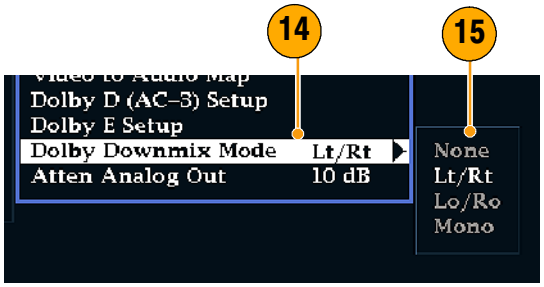



9. **Option DDE only:** Select **Downmix Dynamic Rng.**
10. **Option DDE only:** Toggle to **Line** or **RF**. These Dynamic Range Control (compression) factors are applied when downmixing to the various Dolby D Listening Modes.




11. Select **Dolby E Setup**. The settings you make will apply to the input when Dolby E content is detected for the Dolby input selected.
12. Select **Dialnorm** and toggle to **On** or **OFF**. When On, the dialog normalization is applied to the audio bars and the analog and digital outputs.
13. Select **Pulldown Decoding** and toggle to **On** or **OFF**. When On, pulldown decoding is applied to the audio bars and the analog and digital outputs.



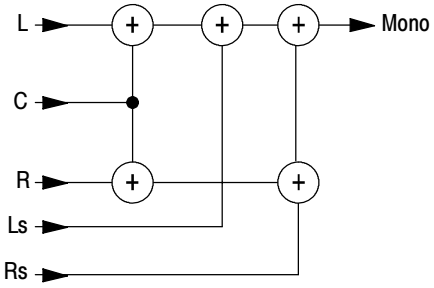



14. **Option DDE only:** Select **Dolby Downmix Mode**. Each downmix mode combines multiple separate audio channels into a mix that provides compatibility for users with only mono or stereo systems, or with older analog surround sound systems.

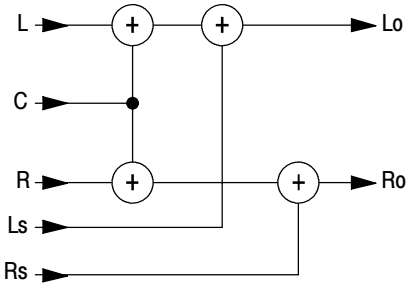
15. Choose one of the following modes to display as two bars in the Audio Display (Option DD is always in Lt/Rt mode.):

    - Select **None** to get no downmix.

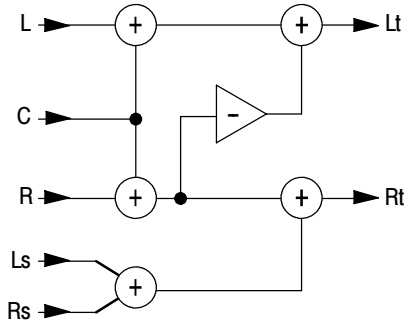
    - Select **Mono** to get the downmix shown right.




    - Select Lo/Ro (Left-only/Right only) to get a standard stereo downmix.




    - Select Lt/Rt (Left-total/Right-total) to get a Dolby Pro-Logic compatible stereo mix.




16. Press the CONFIG button to dismiss the CONFIG menu.

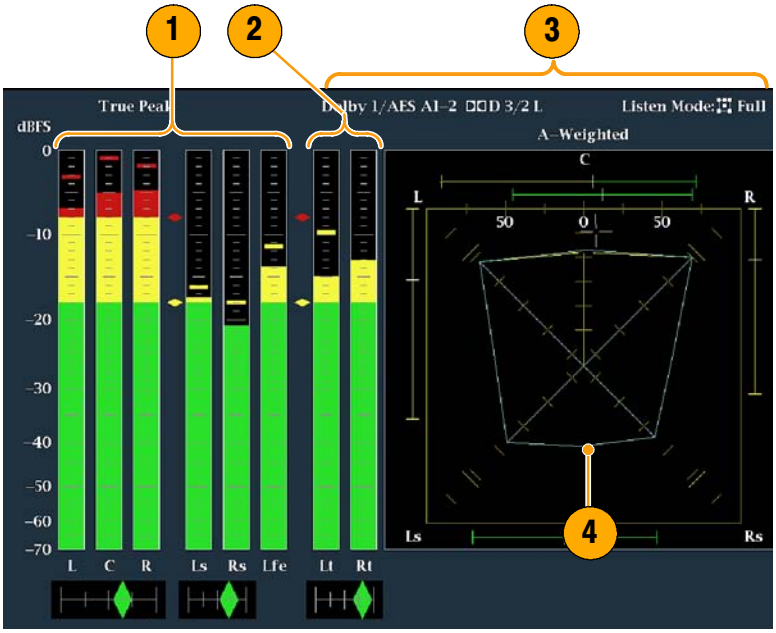
# To Display Dolby Inputs

After you have configured a Dolby input, you can display its levels and other characteristics in the AUDIO Display. (See page 90, *To Configure Dolby Inputs*.)

1. Open the audio monitor in a tile. (See page 84, *To Select the Audio Input*.)
2. Press and hold the Audio button to pop up the Audio menu.
3. Select Audio Input, and select one of Dolby 1 through Dolby 4.

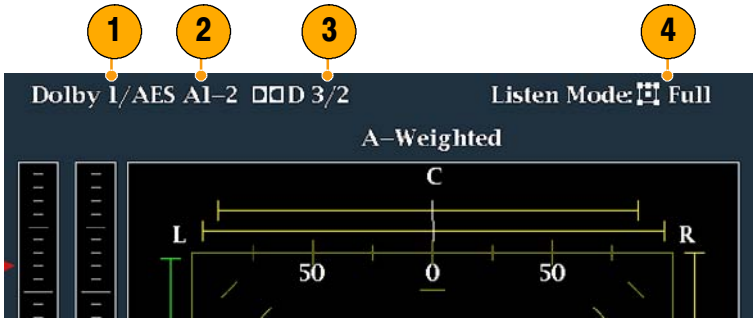
The audio display for monitoring Dolby is shown right.

1. Level bars for Dolby channels. Listening Mode selected determines channels/bars shown.
2. Levels bars for the selected Dolby Downmix mode.
3. Dolby setup information. See *Dolby Display Readout* below.
4. Dolby Listening environment display. (See page 88, *Surround Display Elements*.)




## Dolby Display Readout

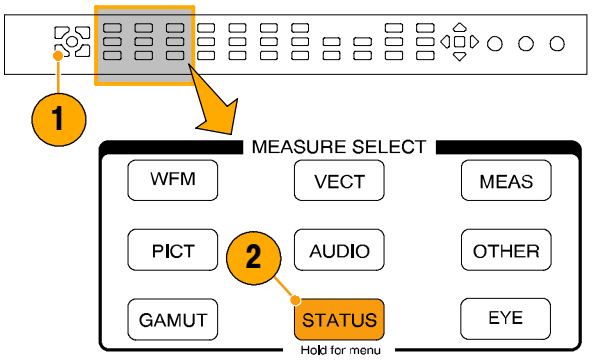
1. The selected Dolby Input.
2. The selected Dolby Source for the input.
3. The Coding (Channel) Mode
4. The Listening Mode setting



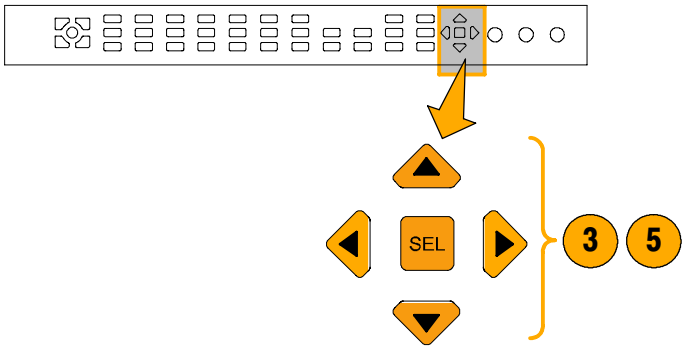
# To View Dolby Metadata

The Dolby-option equipped waveform rasterizer can decode and display in a Dolby Audio Status screen the metadata parameters present in the Dolby D or Dolby E bitstream that you select. To display the data for the currently selected input, do the following procedure:

1. Select a tile.
2. Press and hold the **STATUS** button to open the Status display in a tile and pop up the Status menu.




3. Use the Selection Keys and **SEL** Button to set the menu in the steps that follow.
4. Select **Display Type**, and then select **Dolby Status** as shown. Note the following:
   - A Dolby option must be installed for Dolby Audio Status to display.
   - The Dolby format will match that of the selected input.
5. To activate the display type selected, press **SEL**.



# Usage Notes

- The rasterizer determines the downmix based on your selection (see step 14 on page 95) and using several parameters within the Dolby metadata. For example, if the Dolby Audio Status screen (see step 4 on page 97) shows Extended Bitstream information indicating that the preferred downmix is Lt/Rt, the center channel is attenuated by -3dB and the surround channels attenuated by -6dB before they are combined into the stereo downmix.
- The listening modes (see step 5 on page 93 ) can be used to monitor any multichannel Dolby Digital audio program with a user-selectable number of channels. You can select among several basic and Pro Logic listening modes, the descriptions of which follow. Depending on the Channel Mode, these listening modes affect the content displayed on the Audio Display level bars. (See page 99, *Channel Modes vs. Listening Modes*.)

## Basic listening modes

**EX –** is to be used if the two surround channels have been matrix encoded with a back channel. If the EX listening mode is selected and there are two surround channels present, the bar display will add two back channels, Lb and Rb, to create a 7.1 channel display.

**Full –** does not modify the number of channels indicated by the channel mode in either the display or the outputs.

**3 Stereo –** can be used to monitor the Dolby Digital signal with only the left, center and right channels. In this mode, if there are surround channels present, they are mixed into the left and right channels with the surround mix level attenuation.

**Phantom –** if the center channel is present it gets attenuated with the center mix level value and then added into the left and right channels.

**Stereo –** always creates a Lo/Ro downmix using the center and surround mix levels contained in the metadata. The Lfe is disabled.

**Mono –** Mono mode will always mix down to a single center channel usually by creating a Lo/Ro downmix and adding Lo to Ro. The Lfe is disabled.

## Pro Logic listening modes

Pro Logic listening modes perform different functions depending on what the source material is. If the source is a Dolby Digital stream with three or more channels, then a surround compatible Lt/Rt downmix is created and then decoded into a selectable number of channels. If the source is a 2/0 Dolby Digital stream, then these Pro Logic modes will do a Pro Logic decode to produce the number of channels requested by the listening mode. If the source is PCM, then a full Pro Logic decode is provided regardless of the specific Pro Logic mode selected.

**Pro Logic Full –** will create a Lt/Rt downmix of any input with three or more channels. This Lt/Rt downmix will then be Pro Logic decoded to produce a LCRS output where the surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

A 2/0 encoded Dolby stream will be assumed to be Pro Logic encoded already and will be Pro Logic decoded to produce a LCRS output. Again, the surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

Any PCM input will be decoded the same as a 2/0 Dolby Digital input.

**Pro Logic 3 Stereo -** will create a Lt/Rt downmix of any input with three or more channels. This Lt/Rt downmix will then use Pro Logic decoding to produce a center channel and provide LCR bars.

A 2/0 encoded Dolby stream will be assumed to be Pro Logic encoded already and will be Pro Logic decoded to produce a LCR output.

Any PCM input will be decoded to provide LCRS channels where the surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

**Pro Logic Phantom -** will create a Lt/Rt downmix of any input with three or more channels. This Lt/Rt downmix will then use Pro Logic decoding to produce a surround channel and provide LCS surround channels. This surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

A 2/0 encoded Dolby stream will be assumed to be Pro Logic encoded already and will be Pro Logic decoded to produce a LRS output. Again, the surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

Any PCM input will be decoded to provide LCRS channels where the surround channel is reduced 3dB and reproduced in both the Ls and Rs bars.

## Channel Mode vs. Listening Modes

| Channel Mode | Listening Mode | Main Channel Output Function |
|---|---|---|
| 3/2 | EX | All 3/2 channels + EX decode of back surround |
| | Full | All 3/2 channels |
| | 3 Stereo | 3 Stereo downmix of 3/2 channels |
| | Phantom | Phantom downmix of 3/2 channels |
| | Stereo | Lo/Ro downmix |
| | Mono | Lo+Ro |
| | PL Full | LCRS from Lt/Rt downmix |
| | PL 3 Stereo | 3 Stereo from Lt/Rt |
| | PL Phantom | Phantom from Lt/Rt |
| 2/2 | EX | All 2/2 channels + EX decode of back surround |
| | Full | All 2/2 channels |
| | 3 Stereo | Default to Stereo mode |
| | Phantom | Default to Full mode |
| | Stereo | Lo/Ro downmix |
| | Mono | Lo+Ro |
| | PL Full | LCRS from Lt/Rt downmix |
| | PL 3 Stereo | 3 Stereo from Lt/Rt |
| | PL Phantom | Phantom from Lt/Rt |
| 3/1 | EX | Default to Full mode |
| | Full | All 3/1 channels |
| | 3 Stereo | S mixed into L and R with smix coefficient |
| | Phantom | C mixed into L and R with cmix coefficient |
| | Stereo | Lo/Ro downmix |
| | Mono | Lo+Ro |

| Channel Mode | Listening Mode | Main Channel Output Function |
|---|---|---|
| | PL Full | LCRS from Lt/Rt downmix |
| | PL 3 Stereo | 3 Stereo from Lt/Rt |
| | PL Phantom | Phantom from Lt/Rt |
| 2/1 | EX | Default to Full mode |
| | Full | All 2/1 channels |
| | 3 Stereo | S mixed into L and R with smix coefficient |
| | Phantom | Default to Full mode |
| | Stereo | Lo/Ro downmix |
| | Mono | Lo+Ro |
| | PL Full | LCRS from Lt/Rt downmix |
| | PL 3 Stereo | 3 Stereo from Lt/Rt |
| | PL Phantom | Phantom from Lt/Rt |
| 3/0 | EX | Default to 3 Stereo mode |
| | Full | Default to 3 Stereo mode |
| | 3 Stereo | All 3/0 channels |
| | Phantom | C mixed into L and R with cmix coefficient |
| | Stereo | Lo/Ro downmix |
| | Mono | Lo+Ro |
| | PL Full | LCRS from Lt/Rt downmix |
| | PL 3 Stereo | 3 Stereo from Lt/Rt |
| | PL Phantom | Phantom from Lt/Rt |
| 2/0 | EX | Default to Stereo mode |
| | Full | Default to Stereo mode |
| | 3 Stereo | Default to Stereo mode |
| | Phantom | Default to Stereo mode |
| | Stereo | 2/0 channels |
| | Mono | L+R |
| | PL Full | LCRS from 2/0 channels |
| | PL 3 Stereo | 3 Stereo from 2/0 channels |
| | PL Phantom | Phantom from 2/0 channels |
| 1/0 | EX | Default to Mono mode |
| | Full | Default to Mono mode |
| | 3 Stereo | Default to Mono mode |
| | Phantom | Default to Mono mode |
| | Stereo | Default to Mono mode |
| | Mono | Mono center channel output |
| | PL Full | Default to Mono mode |
| | PL 3 Stereo | Default to Mono mode |
| | PL Phantom | Default to Mono mode |



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## Audio Bar Mapping vs. Dolby E Metadata Program Configuration

For option DDE equipped rasterizers that are decoding Dolby E audio, the bars in the Audio Display are mapped as follows. The mapping derives from the Dolby E Program Configuration detected in the metadata of the Dolby input. If you select a Downmix Pgm (Program) (see step 18 on page 92), the two downmix level bars in the Audio Display reflect that program selection.

| Dolby E Program Configuration | Audio Bar Mapping[1] | Number of Programs Available |
|---|---|---|
| 5.1 + 2 | L, C, R, Ls, Rs, $L_{FE}$ L1, R1 | 2 |
| 5.1 + 2x1 | L, C, R, Ls, Rs, $L_{FE}$ M2, M3 | 3 |
| 4 + 4 | L1, C1, R1, S, L2, R2, C2, S | 2 |
| 4 + 2 + 2 | L1, C1, R1, S, L1, R1, L2, R2 | 3 |
| 4 + 2 + 2x1 | L1, C1, R1, S, L1, R1, M1, M2 | 4 |
| 4 + 4x1 | L1, C1, R1, S, M2 M3 M4, M5 | 5 |
| 2 + 2 + 2 + 2 | L1, R1, L2, R2, L3, R3, L4, R4 | 4 |
| 2 + 2 + 2 + 2x1 | L1, R1, L2, R2, L3, R3, M4, M5 | 6 |
| 2 + 2 + 4x1 | L1, R1, L2, R2, M3, M4, M5, M6 | 6 |
| 2 + 6x1 | L1, R1, M2, M3, M4, M5, M6, M7 | 7 |
| 8x1 = 1+1+1+1+1+1+1+1 | M1, M2, M3, M4, M5, M6, M7, M8 | 8 |
| 5.1 | L, C, R, Ls, Rs, $L_{FE}$ | 1 |
| 4 + 2 | L1, C1, R1, S, L2, R2 | 2 |
| 4 + 2x1 | L1, C1, R1, S, M2, M3 | 3 |
| 2 + 2 + 2 | L1, R1, L2, R2, L3, R3 | 3 |
| 2 + 2 + 2x1 | L1, R1, L2, R2, M3, M4 | 4 |
| 2 + 4x1 | L1, R1, M2, M3, M4, M5 | 5 |
| 6x1 | M1, M2, M3, M4, M5, M6 | 6 |
| 4 | L1, C1, R1, S | 1 |
| 2 + 2x1 | L1, R1, M2, M3 | 3 |
| 4x1 | M1, M2, M3, M4 | 4 |
| 7.1 | L, C, R, Ls, Rs, $L_{FE,}$ Lb, Rb | 1 |
| 7.1 Screen | L, C, R, Ls, Rs, $L_{FE,}$ Le, Re | 1 |

1 L = Left, R = Right, C = Center, M = Mono, S = Surround
e = extra (Le and Re and Ex encoded channels), b = back
$L_{FE}$ = Low Frequency Effects

# How to Monitor Closed Captioning (CC) and Safe Area Compliance

The waveform rasterizer can monitor for any CC data, including V-Chip ratings, present in the selected signal and display the data overlaid on the PICT display. EIA-608-Line21 (VBI), EIA-608 (ANC), and EIA-608 (708) closed caption transports are supported.

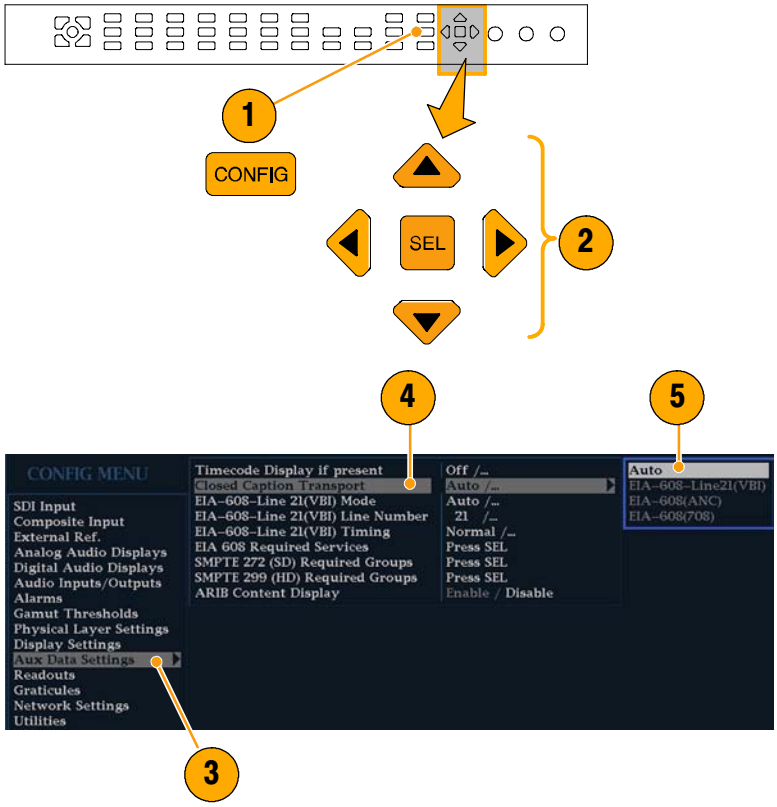
The waveform rasterizer can also display Safe Action and Safe Title graticules to let you monitor for incorrect placements of graphics, logos, and other branding elements, to ensure that they do not obscure text or essential action. SMPTE, ITU, and ARIB TR-B.4 standards are supported.

## To Monitor Closed Captioning

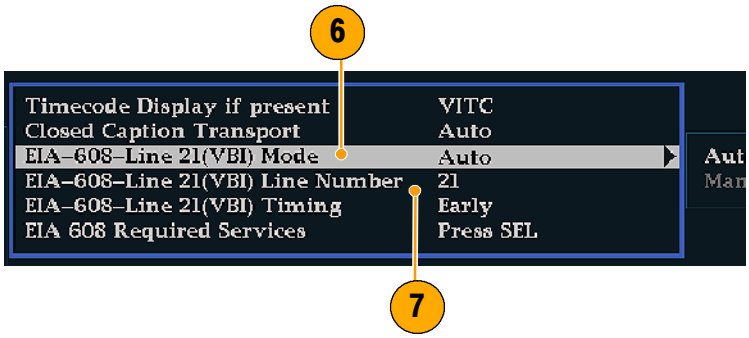
### To Configure Closed Captioning

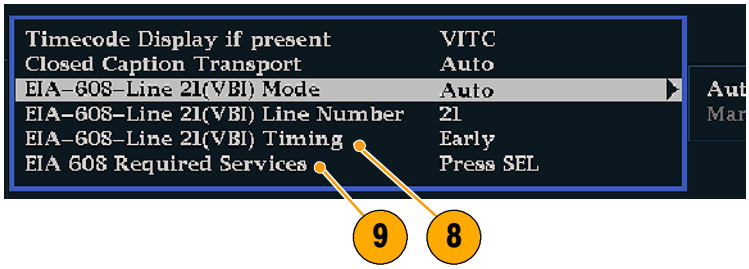
Before using Closed Captions, configure them from the CONFIG menu:

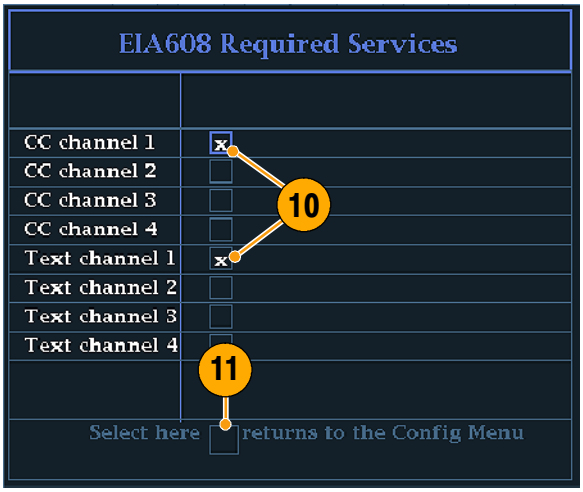
1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and **SEL** Button to set the menu in the steps that follow.
3. Select **Aux Data Settings.**
4. Select **Closed Caption Transport**.
5. Select one of the CC stream types, or select **AUTO** to search for closed caption streams in the following order and present the text of the first stream type detected:
   - For Composite:
     EIA-608-Line 21 (VBI)
   - For SD:
     EIA-608-Line 21 (VBI)
     EIA-608 (ANC)
     EIA-608 (708)
   - For HD:
     EIA-608 (ANC)
     EIA-608 (708)



6. Select **EIA-608-Line 21(VBI) Mode**, and choose **Manual** if you want to choose the EIA 608 Transport directly (see step 7) or **Auto** if you want the rasterizer to select it automatically.
7. Select **EIA-608-Line 21(VBI) Line Number,** and choose which EIA 608 Transport is assumed when displaying closed captioning. (Manual must be Mode set in step 6.)
8. Select **EIA-608-Line 21(VBI) Timing** and choose **Normal.** You can also choose **Early** or **Late**, if the signal is mistimed.
9. Select **EIA 608 Required Services** (press **SEL** button).
10. Select which service types trigger alarms when they are missing from the EIA-608 stream.
11. Select this box to return to the CONFIG menu.
12. Press the **CONFIG** button to close the CONFIG menu.

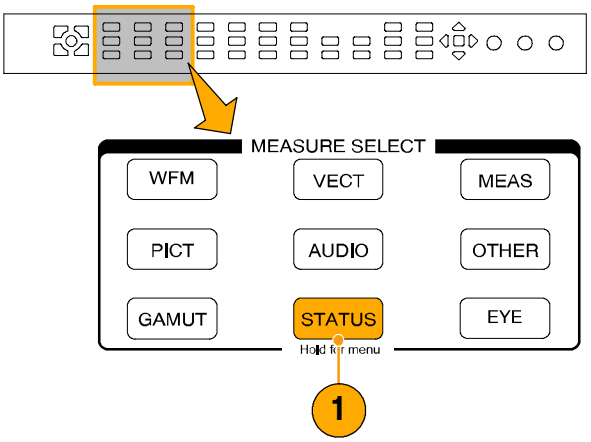


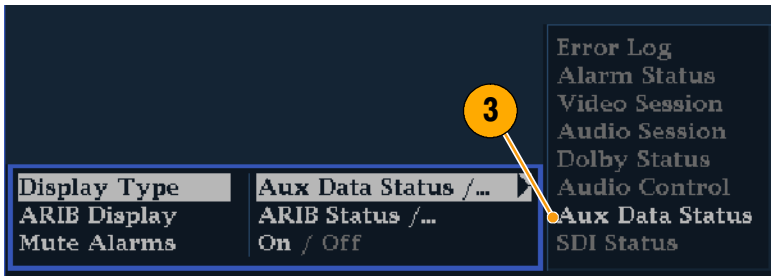



## To View Closed Captioning Status

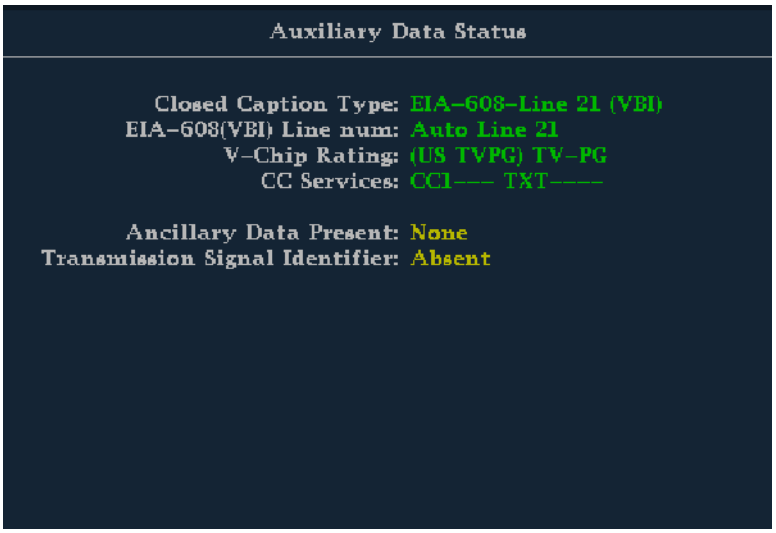
1. Press the **STATUS** button to select the Status display mode.
2. Press and hold the **STATUS** button to display the pop-up menu.




3. Select **Display Type** and then select **Aux Data Status**.

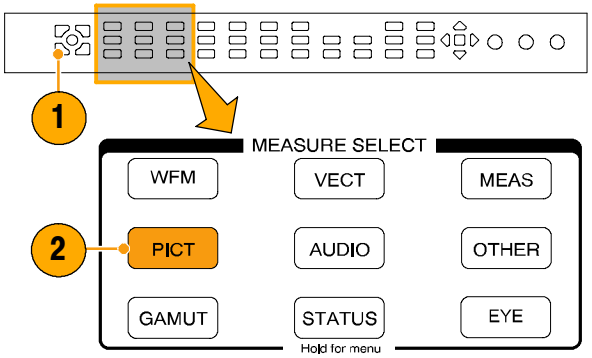



4. The **Auxiliary Data Status** display shows the status of the closed caption data.


Auxiliary Data Status
Closed Caption Type: EIA-608-Line 21 (VBI)
EIA-608(VBI) Line num: Auto Line 21
V-Chip Rating: (US TVPG) TV-PG
CC Services: CC1--- TXT----
Ancillary Data Present: None
Transmission Signal Identifier: Absent

## To Display Closed Captioning

1. Select a tile.

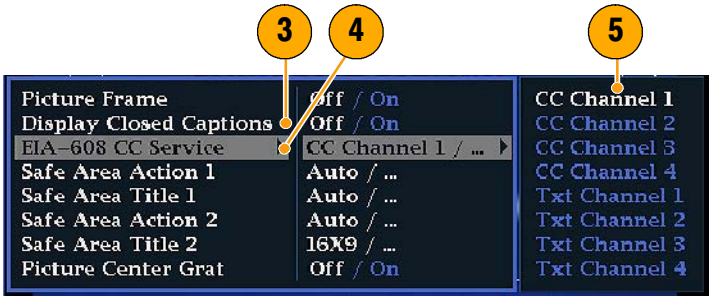



2. Press and hold the **PICT** button to display the pop-up menu.

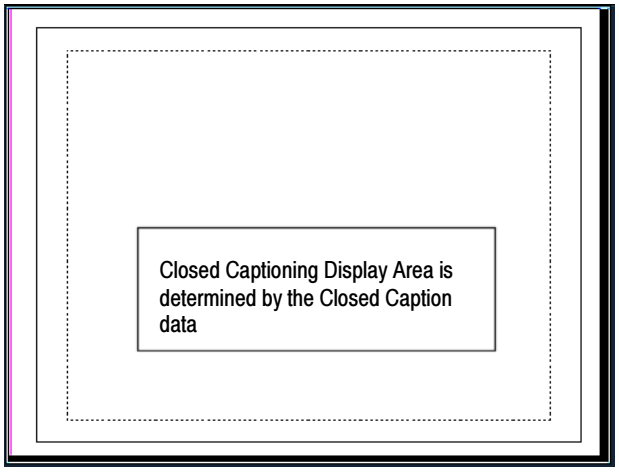
3. Select **Display Closed Captions,** and toggle it to **On**.

4. Select **EIA-608 CC Service.**

5. Choose one of CC channels 1-4 or text channels 1-4.




The PICT display includes Closed Captioning in the area designated by the Closed Caption data.




6. Press the **PICT** button again to dismiss the the pop-up menu.

## Usage Notes

- PICT displays in individual tiles allow their EIA-608 CC Service to be selected independently.
- CC text is not captured with the Picture image when using Freeze.
- CC setups are also stored when saved with Presets and restored on power up.
- The CC alarms are available in the CONFIG Alarms menu under Closed Captions/Metadata.

# To Monitor for Safe Area Compliance

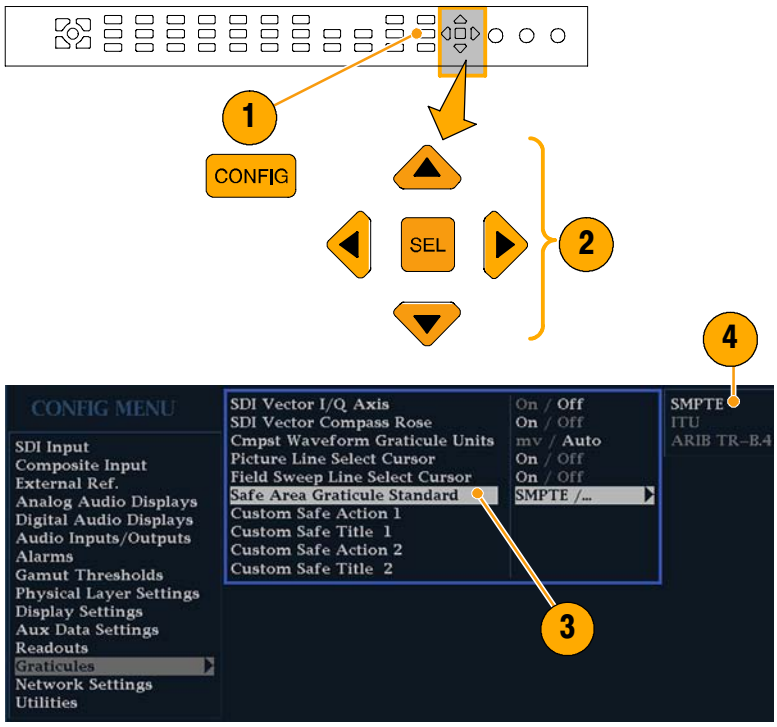
To display graticules for monitoring for incorrect placements of nonessential elements relative to essential ones, set global settings in the CONFIG menu, and turn on up to four Safe Area graticules, each with independent settings, in the PICT menu.

## To Configure Safe Area Graticules

Before using Safe Area Graticules, configure them from the CONFIG menu:

1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and **SEL** Button to set the menu in the steps that follow.
3. Select **Graticules,** and then select **Safe Area Graticule Standard.**
4. Choose from the **SMPTE**, **ITU**, **or ARIB TR-B.4** standards.

   The selection you choose will be the graticule used when **AUTO** is chosen for any of the four Safe Area Graticules, accessed in the PICT menu.



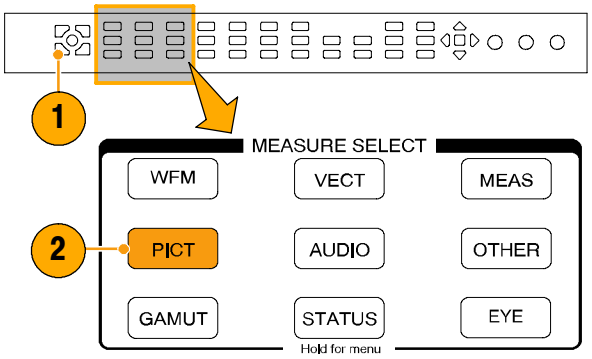

5. If you want, set the Height, Width, and Offsets of the title and action areas for Custom Safe Graticules 1 and 2. First select the title or action to change.
6. Then select the parameter.
7. Then set the percentage level for each of the parameters.

   Parameters are set as a percentage of screen height or width, and you can watch the graticules update on screen as you vary them.

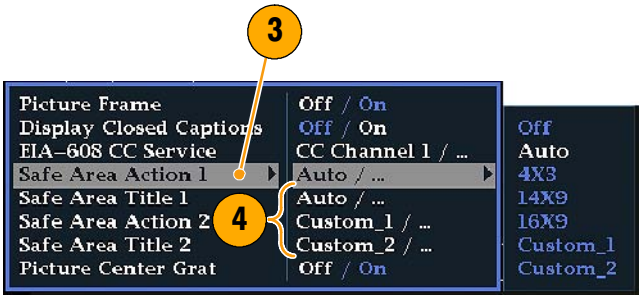
   The custom parameters you set will be used when **Custom_1** or **Custom_2** is chosen for any of the four Safe Area Graticules accessed in the PICT menu.
8. Press the **CONFIG** button again to close the CONFIG menu.

## To Display Safe Area Graticules

1. Select a tile.



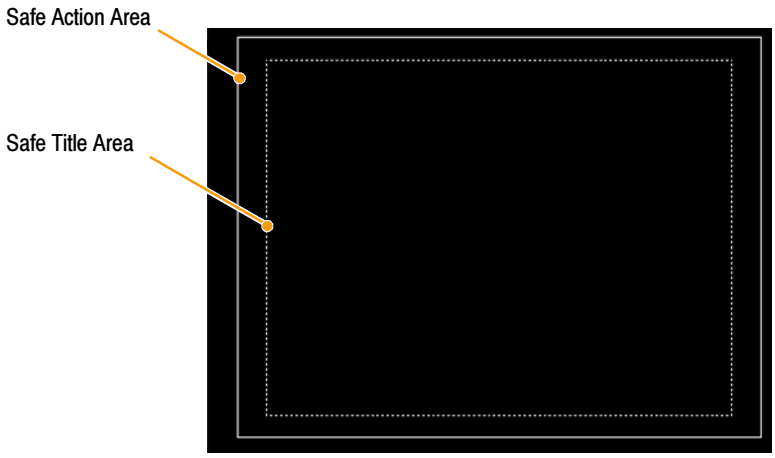

2. Press and hold the **PICT** button to display the pop-up menu.
3. Select Safe Area Action 1.




4. Select one of the following choices:
   - **Auto** to let the rasterizer automatically select the size and offsets of the safe area.
   - **4x3**, **14x9**, or **16x9** to set the safe area size and offsets appropriate for these aspect ratios based on the selected standard.
   - **Custom_1** or **Custom_2** to set the safe area size and offsets to match the custom settings in the Graticles CONFIG menu. See step 5 on page 106.
5. Repeat step 4 for each Safe Area selections.
6. Press the **PICT** button again to dismiss the the pop-up menu.

## Usage Notes

- The Safe Action Area denotes the maximum image area within which all significant action should be contained; the Safe Title Area denotes the maximum image area within which all significant titles should be contained.
- Safe Area Graticules can globally be configured to comply to accepted standards in the CONFIG menu.
- Custom selections for vertical and horizontal size and offset of the Save Areas can be set in the CONFIG menu.



# How to Use Alarms

The rasterizer alarms automatically monitor parameters and report when they exceed limits. The procedures that follow describe how to configure response types for individual alarms, how to enable them, and how to monitor them.

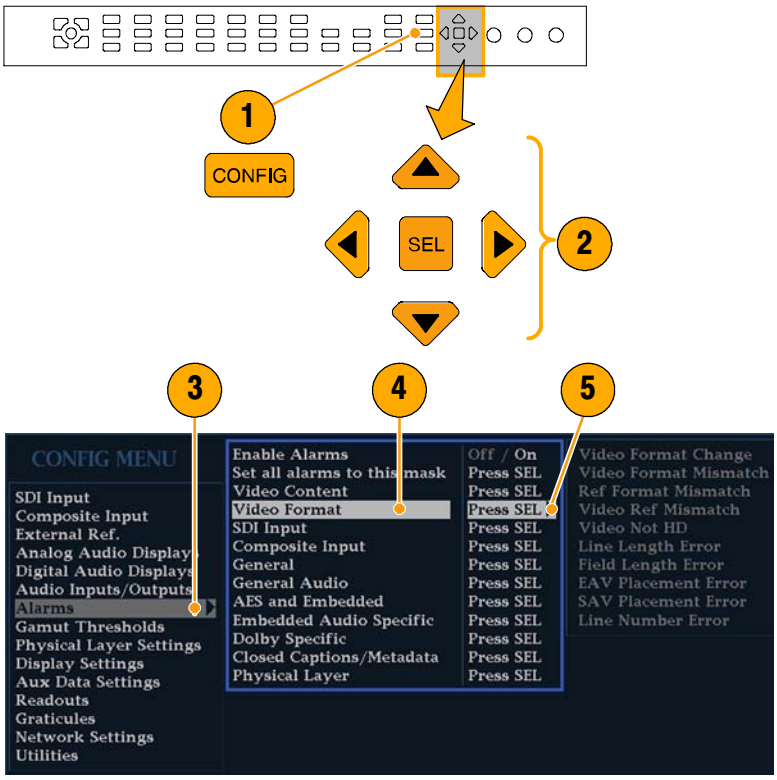
## To Configure Alarms

The rasterizer alarms may need to be configured in the CONFIG menu before you use them (they come set to FACTORY defaults, which you can restore using the FACTORY front-panel button). Do this procedure (or at least check that the alarms are configured as you want them) before doing the procedures that start on page 84. You select alarms in the following categories and select which error conditions you will monitor and how you will be notified in the event of an error:

- Video Content
- Video Format
- SDI Input
- Composite Input
- General
- General Audio
- AES and Embedded
- Embedded-Audio Specific
- Dolby-Specific
- Closed Captions/Metadata
- ARIB Specific
- Physical Layer

### To Set Allowed Alarm Responses

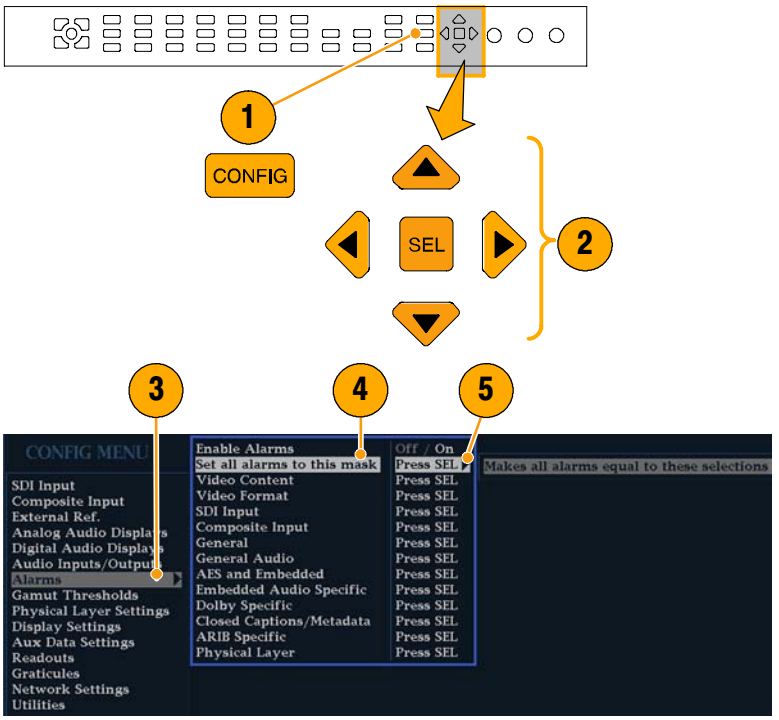
1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and Sel Button to set the menu in the steps that follow.
3. Select **Alarms**.
4. Navigate to the alarm category that you want to configure; for example, **Video Format** alarms is highlighted.
5. Note that the alarms of the category you select appear to the right as you highlight the alarm category. Press **SEL** to display a table for setting the allowed responses for each individual alarm.



6. For each alarm listed in the table, select the box to place (or remove) an X in the box under each response that you want enabled (or disabled) for that alarm. See *Possible Alarm Responses* on the following page.
7. Navigate to highlight the **Return** box, and press the **SEL** button to return to the CONFIG menu.
8. Repeat steps 4 through 7 to configure as many types of alarms as you want.

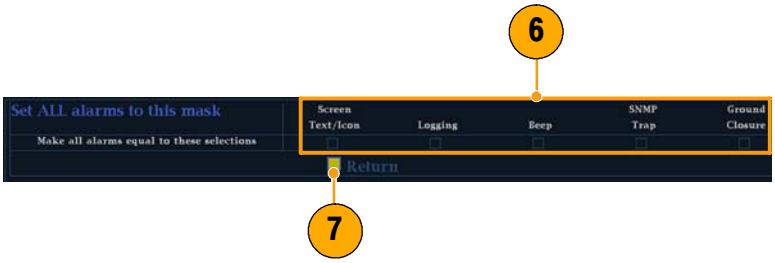
## To Set Alarm Responses Globally

1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and Sel Button to set the menu in the steps that follow.
3. Select **Alarms**.
4. Navigate to **Set all Alarms to this Mask**.
5. Press **SEL** to display a table for setting the allowed responses for alarm settings to be applied to all alarm categories.




6. For each alarm listed in the table, select the box to place (or remove) an X in the box under each response that you want enabled (or disabled) for that alarm. See *Possible Alarm Responses* on the following page.
7. Navigate to highlight the **Return** box, and press the **SEL** button to return to the CONFIG menu.

   This sets alarms for all alarm categories to the setting on the global mask.



## Possible Alarm Responses

For each available alarm, you can select up to four of the responses listed. *Note that if you do not select a notification method for an error, you will not be notified if that error occurs.*

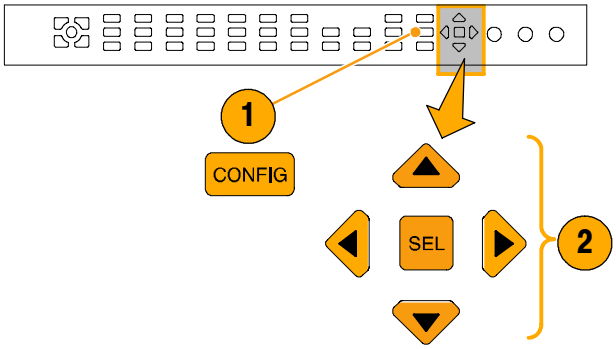
- Screen Text/Icon. An icon appears at the bottom of the current display. This notification method is disabled when the Configure menu is open.
- Logging. The instrument makes an entry in the Event Log. Refer to *Status Display* in the *Supplemental Operating Information* chapter of the *WVR61000 and WVR7100 User Technical Reference Manual*.
- Beep. The instrument makes an audible alarm.
- SNMP Trap. The instrument sends an SNMP trap out the Ethernet port for a remote notification that an alarm condition occurred. You must enable and configure the instrument for SNMP control using the Network Settings submenu of the Config menu before SNMP traps can be sent. Refer to the *WFM Series Waveform Monitors and WVR Series Waveform Rasterizers Management Information Base (MIB) Technical Reference* (located on the User Documents CD) for more information about using SNMP alarm notifications.
- Ground Closure. The instrument sends a signal out the Remote port for a remote notification that an alarm condition occurred. You must enable the Remote Control Port in the Communications submenu of the Configure menu before notifications can be sent.

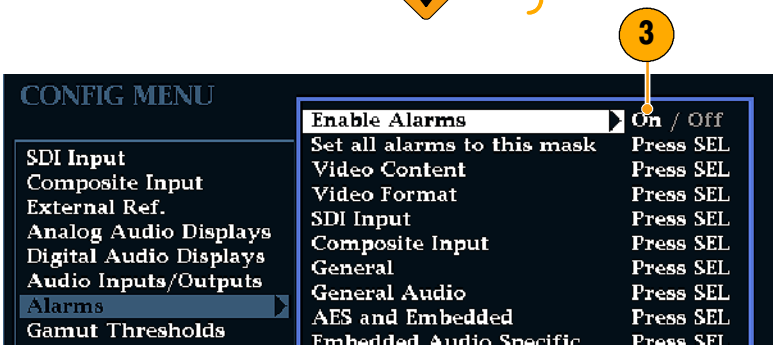
***NOTE**. To monitor alarm status, see* To Monitor Alarms *on page 113.*

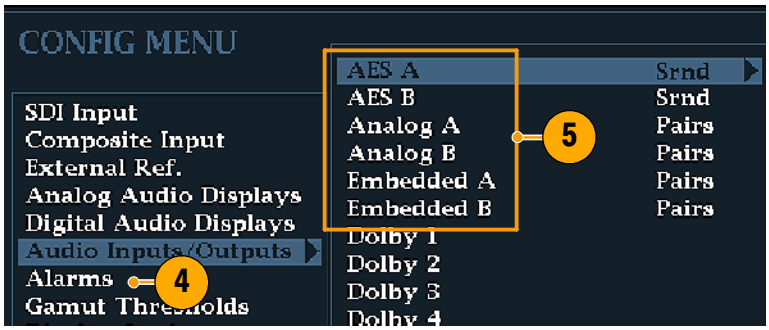
## To Enable Alarms

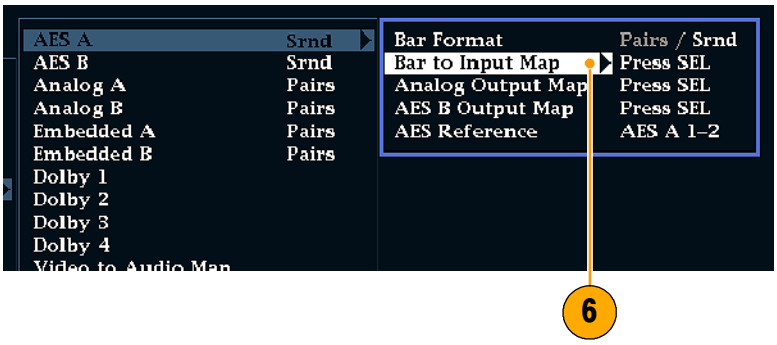
The channels for which you enable alarms here trigger the alarm responses that you defined. (See page 108, *To Set Allowed Alarm Responses*.)

1. Press the **CONFIG** button to display the Configuration menu.
2. Use the Selection Keys and Sel Button to set the menu in the steps that follow.
3. To globally enable all alarms, select **Enable Alarms** and toggle it to **On**. This turns on all alarms that are individually enabled, and provides a quick way to switch them on and off without changing their individual settings (see step 4).
4. Additionally, for Audio inputs, you must enable alarms individually for their channels. To start, select **Audio Inputs/Outputs** in the CONFIG menu.
5. Select each input shown in the box to individually enable its alarms. AES A is shown selected.
6. For each of the AES, Analog, and Embedded inputs, select **Bar to Input Map**, and press the **SEL** button to display the **Bar to Input map.**

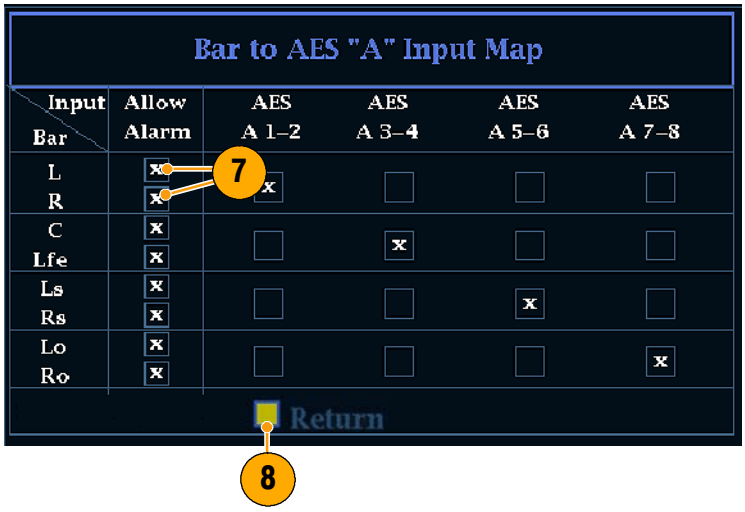


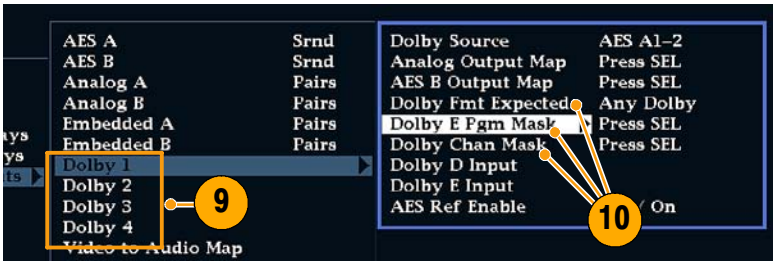



7. Navigate to each box for each alarm that you want to allow. Press the **SEL** button to enable it **(X)** or disable it (blank) for each channel displayed.
8. Select the box, and press the **SEL** button to return to the CONFIG menu.




9. For Dolby 1 - 4, you must also enable alarms individually.
10. Select the **Dolby Fmt Expected, Dolby E Pgm Mask** and/or **Dolby Chan** and configure them as you want.

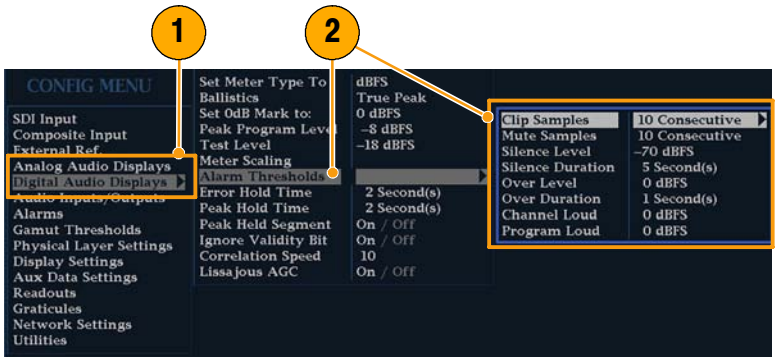
    Whether these selections are available depend on Dolby options installed; see the procedure *To set up Dolby Input Parameters*, starting on page 90, for instructions on configuring the alarms for the Dolby inputs.




## To Set Limits or Qualifications

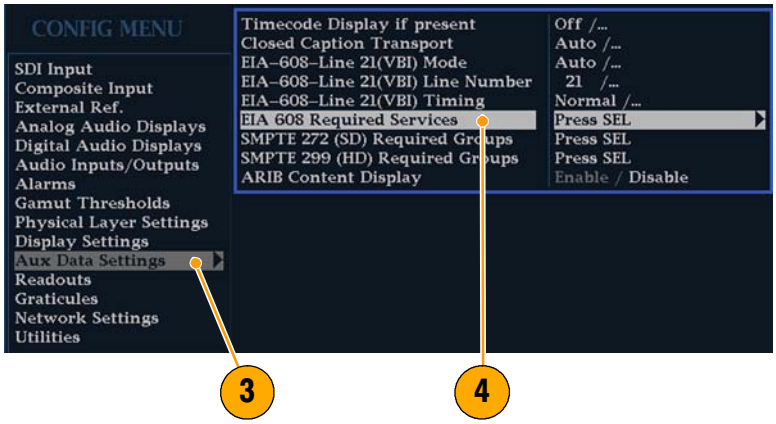
Some alarms also require setting a threshold or condition that triggers the alarm.

1. Select in turn **Analog Audio Displays**, **Digital Audio Displays.**
2. For each selection in step 1, set the following alarm levels that trigger an alarm when exceeded:
   - Clip Samples: number of consecutive samples at the all-high level.
   - Mute Samples: number of consecutive all-zero samples.
   - Silence Level: The level below which audio is considered not present.



- Silence Duration: The length of audio silence time allowed
- Over Level: the too-loud audio level
- Over Duration: The length of time limit for the too loud audio

3. For Closed Caption related alarms, select **Aux Data Settings**.
4. Select EIA608 Required Services, and select the CC channels and/or Text channels that you want to trigger the CC Services Missing Alarm.




## To Monitor Alarms

- To quickly check if any error condition exists, look for either the screen alarm icon or the screen alarm text. These are described under *Status Bar Icons,* on page 14, and *To Determine Status at a Glance,* on page 13.
- To increase visibility of alarms, select audible response (Beep) or the Ground Closure output response. The latter can be used to drive a light or audible alarm when one or more alarms are triggered. See *To Set Allowed Alarm Responses* on page 108.
- To check the condition of specific alarms, press the Status button. In the Status pop-up menu, select Alarm Status. Note the following status:
  - Disabled (gray): Alarm is disabled.
  - OK (green): Alarm triggered but now OK for at least 5 seconds.
  - Error (yellow): Alarm condition cleared for less than 5 seconds
  - Error (red): Alarm triggered now.
- To monitor alarms remotely, use a PC to monitor SNMP traps over the Ethernet port (the PC must have SNMP trap service installed). You must enable and configure the instrument for SNMP control using the Network Settings submenu of the CONFIG menu before SNMP traps can be sent. Refer to the *WVR61000 and WVR7100 User Technical Reference Manual* (located on the User Documents CD) for more information.

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